JOURNAL

OF

FARM ECONOMICS

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ANNOUNCEMENT.

The annual meeting of the American Farm Economic Association will be held at the Auditorium Hotel, Chicago, November 11–13, 1919.

These dates overlap the meeting of the Association of Agricultural Colleges and Experiment Stations on November 12 and 13 and the National Country Life Association on November 11. Plans are being made to hold joint sessions with these Associations.

Indications are for a large attendance. The coming conventions should afford an excellent opportunity to exchange ideas, meet others in the same field of work and profit by the expression of leading authorities in the various discussions of present-day problems.

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PROGRAM.

Among the several topics that will be discussed at the annual meeting in Chicago will be Farm Organization Problems by Professor Boss of Minnesota and Professor Handschin of Illinois with audience discussion led by Livermore of New York and Mayland of North Dakota.

Price problems will be ably presented by Dr. Warren of New York and Dr. Cance of Massachusetts, with discussion led by Henry Wallace of Iowa.

Farm survey studies will be discussed by H. M. Dixon of the Office of Farm Management, Professor Nicholls of Kentucky and Professor Leitch of Guelph, Ontario.

Land problems are to be presented by Professor Ely of Wisconsin, O. G. Lloyd of Iowa and Dr. Gray of the Office of Farm Management.

Farm Labor Problems and Farm Management Extension Work

will also hold prominent places on the program. Dean Davenport of Illinois and Professor Graham of the States Relations Service have consented to assist with these subjects.

IMPORTANT MEETINGS TO BE HELD IN CHICAGO THE WEEK OF NOVEMBER 10–15.

November 12–14. Association of Agricultural Colleges and Experiment Stations, Auditorium Hotel.
November 11–13. American Farm Economic Association, Auditorium Hotel.
November 8–11. National Country Life Association, La Salle Hotel.
November 10–11. Association of State Departments of Agriculture, Auditorium Hotel.
November 11–12. Federated Farm Bureaus.
November 11–12. American Society of Agronomy, Auditorium Hotel.

The last annual meeting of the American Farm Management Association was reported as one of the best held thus far by this organization. There was a wide range in the subject matter selected for presentation and discussion. The papers were all carefully written and were read in a forceful, convincing manner. A keen interest was maintained in the program from the beginning of the opening session on Wednesday morning to the completion of the business meeting on Friday afternoon. Heretofore all papers assembled on the occasion of the annual meeting have been published, together with the minutes of the Association, in a single yearly report. In making the change this year from an annual report to a quarterly journal, we find that it will not be possible to print all of the papers which were placed at our disposal. If sufficient funds had been available, the size of each number of the JOURNAL could have been increased and practically all manuscripts would have been utilized. The executive committee decided to contract obligations only in so far as the income of the treasury would permit us to meet these expenses during the current year. The signs of the times indicate an expansion of the association membership, and it appears to be safe to predict that there will be sufficient space next year to care for all matters relating directly to the annual meeting.

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THE JOURNAL OF FARM ECONOMICS should contain more than a complete report of the proceedings of the annual sessions of the

American Farm Economic Association. This meeting usually comes in November. Several manuscripts must of necessity be held for the third and fourth issues, which, under normal conditions, are printed about one year following this meeting. We may reserve the very best material for the last number, and yet, despite any prophetic touch that may be given, we are inclined to consider such papers as old or out of date. The period through which we are passing has witnessed many exceedingly abrupt changes. In the adjustment of economic conditions within the coming decade, there will be opportunity for sober and intelligent discussion of the problems of the farmer. If this JOURNAL is to accomplish its mission, it will deal frankly in current issues, with the things which are of vital importance not only from the standpoint of the producer, but also from the viewpoint of the consumer. Very meager information concerning the economic environment of the man behind the plow has been given to the general public. Consequently, there is ample room for constructive effort in this virgin field. It will be the purpose of the editorial staff to bring together each quarter a few concise articles dealing with up-to-the-minute topics on Farm Economics.

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During the summer months the daily press has devoted considerable space editorially and otherwise to the high cost of living. Some of this effort might well have been expended in pointing out ways and means of overcoming the cost of "high living" in our cities. A direct attack upon the prices paid for farm products was entirely out of place and unwarranted. If these preachments had been accompanied with a full statement of the underlying facts, there would have been some justification for the time and energy devoted to these subjects. Invariably the producer's side of the question was ignored, and final judgment was passed without bringing the case into court. This issue of the JOURNAL contains three articles which describe quite fully the producer's side of production costs and they point out some of the more important features of farm organization.

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THE STATUS OF THE MEMBERSHIP OF THE ASSOCIATION.

An attempt has been made to launch a membership campaign for the Economic Association by the appointment of a leader for this project in each Agricultural College. Gratifying results are begin-

ning to show from several of the States. Eight new members came in one notice from Iowa and four from Texas. The Secretary appreciates the efforts being spent by interested members in pushing for an increased membership. We need 750 members by November 11, the date of the annual meeting. This will mean 150 new members between September 15 and the second week in November.

The principal concern at the present time is not new members, however, but the status of the unpaid old members. Three notices, with personal letters, have been sent to the old members and at this writing there remains outstanding $260, representing 137 old members who have not paid their 1919 dues. This may not be serious if the bills are paid but each one is receiving the JOURNAL OF FARM ECONOMICS with confidence that it will assist in keeping their names on the roll.

The Secretary desires to make a solvent report of the affairs of the Association at its annual meeting. This will be possible only by the payment of the dues of the old members. The 1919 year will be a record-breaker if every member pays up. We know the intentions are good, but the publishers of the JOURNAL have indicated that cash, only, will meet their requirements.

IMPORTANT FACTORS IN THE COST OF PRODUCING WHEAT.

ANDREW BOSS,
UNIVERSITY FARM, ST. PAUL, MINN.

For something over two years the importance of wheat production has been emphasized and kept before the world, first by agitation for a guaranteed price for wheat during the war and second, by more or less serious attempts to determine the cost of producing wheat. Many citizens of America have had the lesson well driven home during war times by having to go without wheat flour entirely or in part.

While wheat-bread-eating people the world over recognize more fully than ever before the value and importance of wheat flour very few of them know what it does cost or ought to cost to produce a bushel or an acre of wheat. Even the farmers who produce the wheat know but little of the cost of producing it. While fertile prairie lands were cheaply available the matter was of little consequence and they were satisfied if they could earn a living rate of wages by growing wheat. Little account was taken of the factors of cost in producing wheat and no account whatever of the drain on soil fertility which went steadily on. Many farmers who have thought they were making wages or a living out of raising wheat are in reality only cashing in the fertility of their land. Run down and deserted farms everywhere give evidence of this.

The population of the world wants wheat flour. The farmers on wheat growing land are the only ones who can produce it. If they are to produce it they must receive for it a sufficient return to enable them, with their families, to live comfortably and to maintain the fertility of their farms. It is, therefore, important to know the factors of cost in wheat production and to find places where costs can be reduced or eliminated.

IMPORTANT COST FACTORS IN PRODUCING WHEAT.

The factors of cost in present time wheat production in the spring wheat growing section of America may be classified in the order of importance as follows: Labor (man and horse), land, seed, machinery, threshing costs, general expense, and twine cost. Fertilizer cost or values consumed is just as legitimately a cost as the preceding

items, but no one has as yet devised a satisfactory basis for determining what this cost is. No charge is commonly made, therefore, for soil fertility consumed in making a wheat crop except where commercial fertilizers or manures have been purchased for cash.

Labor Costs.

The cost for man and horse labor constitutes the largest item of cost in wheat production. It was found to be 41.4 per cent. of the total cost in Minnesota during the years 1913–1917.[1] With increasing wages for man labor and much higher feed cost for horse labor than prevailed during that period the labor cost now assumes an even greater proportion of the total. The opportunity for cutting the man labor cost lies in efficient management. The average hours of man labor required in Minnesota were found to be 12.3 and of horse labor 29.9. Some farmers by the use of large implements and effective methods are able to reduce the amount to 10 hours or less of man labor and 25 hours of horse labor. The cost of producing an acre of wheat would be, therefore, considerably less than the average. The rate paid for man labor is a factor of importance in the aggregate cost of an acre of wheat which is but little subject to variation during the season. The rate of horse labor, however, may be controlled to a considerable extent by the kinds and amounts of foods fed and especially by the number of hours of labor performed annually per horse.

The Land Factor.

Land is one of the largest factors in wheat production. Not all land is suited to wheat production. Climate also affects the growth and influences greatly the yield and quality of the wheat and ultimately the cost of producing it. Land that will grow wheat and that is favorably located as to climate is limited and is becoming increasingly more expensive.

It is much more difficult to grow wheat profitably on $200 land than on $100 land. It has been estimated that to secure the same per cent. of profit on investment on $100 land as on $25 land a yield more than 4 times as great must be obtained. The charge for the use of land may be computed from one of two bases. It may be charged at rental value where cash rent is paid or the rental value can be otherwise determined. Or the charge may be made up of the items of cost, which are interest on the investment in land, taxes, upkeep of drains, fences, and other land improvements. Where the values are

[1] Bulletin 179, Minn. Agr. Expt. Sta.

affected by proximity to a large city or market with a strong demand for town lots or where values are greatly affected by speculation as is now the case in the north central area the rental value is perhaps the safest basis.

In normal times where values fluctuate less wildly, the interest on investment basis is quite satisfactory. In determining the interest charge prevailing prices of land exclusive of buildings should be used and interest figured at the rate at which money may be borrowed on well secured farm loans.

In cost of production studies in Minnesota, 1913–17, the cost for the use of land was calculated to be $4.60 an acre or 28.2 per cent. of the total cost. Land values have since risen and present costs are much larger. There is no way to reduce this acre cost for land in wheat production except to grow wheat on cheaper land. The bushel cost could of course be reduced by increasing the yield, provided the increase can be secured without corresponding increase in other expenses.[2]

Seed Cost.

The seed cost of wheat is determined by the quality and quantity used and the market value. This is an easy figure to secure when bought for cash. When taken from the farmer's own bin, however, it is not always so easily determined. It has been agreed by farm economists that products used for seed should be charged against the crop grown at the prices at which the crops from which they are taken are credited, costs for cleaning or otherwise preparing to be added. The seed cost in Minnesota 1913–17 was 11.4 per cent. of the total cost of growing an acre of wheat.

Machinery Cost.

Machinery plays a large part in wheat production. In fact it is because the wheat crop can be so well handled by machinery that it is so popular with farmers. The cost for machinery, however, is not fully recognized by wheat growers. And it is difficult to determine accurately the cost for machinery for a specific crop where so much of the machinery is purchased and used for all crops in common.

The charge for the use of machinery is made up of depreciation, interest on investment, cash repairs, and oils, labor for repairs and care of machinery.

Depreciation may be roughly calculated at 10 per cent per year, though in studies made in Minnesota the recorded depreciation over

[2] Bulletin 179, Minn. Expt. Sta.

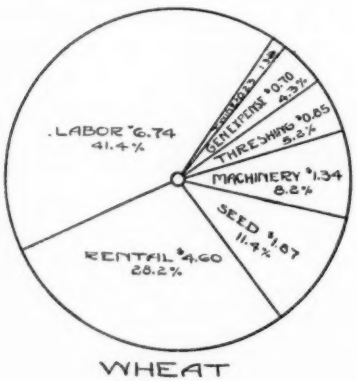
a long period of years was found to be only 7.3 per cent. There is a wide difference in rate of depreciation for different machines and also on different farms. One farmer's cost for machinery may be very much more than anothers.[3]

In order to correctly charge machinery values it is necessary to determine the acre cost of each machine and distribute it to the various crops concerned. The cost for machinery has greatly increased during the past two or three years owing to the increased price for new machines, the increased cost of labor and repairs and other expense of maintenance. This increase is estimated to be 60 to 75 per cent. The cost for machinery in producing wheat in Minnesota, 1913–17, was found to be 8.2 per cent of the total cost.

Cash—Threshing Costs, General Expense and Twine.

The minor costs in wheat growing are composed of the cash cost for threshing which is approximately 5.2 per cent. of the total, general expense 4.3 per cent, and twine cost for binding which is 1.3 per cent.

The proportionate cost is well represented by the accompanying illustration which is taken from Bulletin 179, Minn. Agr. Exp. Sta.



[3] Bulletin 179, Minn. Agr. Expt. Sta.

PRINCIPLES INVOLVED IN FIXING THE PRICE OF MILK.[1]

F. A. PEARSON,

URBANA, ILLINOIS.

With the advent of the war, most farm management men followed the American economists, who had grave misgivings concerning any policies of price fixing. Our economic literature has maintained in general that legally fixed prices are either futile or harmful except in the case of monopoly.

The difficulty of maintaining fixed prices at a point satisfactory to buyers and sellers, the danger of forcing legitimate industry into serious situations, and the risk of curtailing or shifting production have been the primary arguments against such governmental policies, all of which have been abundantly illustrated from the records of such attempts.

Price fixing policies may be said to rest upon legal forces, moral forces, and economic forces. Legal forces rest with physical power which is administered by certain governmental agencies. Moral forces exert their power through honor, public commendation, disgust, and social ostracism. Economic forces exert their influence by changes in production and consumption. The sudden change in our policy from freedom of control to our present day complicated system of price control has outstripped theory.

Our present policy of fixing prices can not be said to be a complete failure as predicted by some, nor can it be said to be a complete success. Success of governmental agencies involved in price fixing rests on the fact that these agencies have been guided by economic forces and have been supported by moral and legal forces. Artificial price-fixing policies must be flexible enough in order that these artificial restrictions will act more or less in the same way as an increase or decrease in consumption, which will be sufficient to counteract changes in supply. Economic forces are, no doubt, dominant, but legal and moral forces may play a large part.

[1] Paper read before the American Farm Management Association at Baltimore, Maryland, January, 1919.

Historical Aspect.

Except in the case of monopoly, the Anglo-Saxon race has experienced little or no price fixing since the mediæval period. The church was not only dominant during the mediæval period, as now in the religious life of peoples, but played a large part in both the political and economic sphere. Without our modes of transportation and means of storing food from seasons of plenty to seasons of scarcity, the poorer classes suffered from food shortages and the wealthier classes often reaped large profits at the expense of the more unfortunate. To counteract the suffering of the poorer classes, the church, often regulating prices without regard to economic phenomena, was usually unsuccessful. Following the experience of the mediæval period, which attempted to regulate prices by moral force, the English economists roundly denounced all kinds of price interference. From the time of Mill until the present day, the world has experienced freedom from price regulations. Everything was left to supply and demand. The consumer protected himself against high prices through decreased consumption and the producer by decreased production. With freedom of trade and our enormous production, both parties were well safeguarded.

With the advent of the war, restriction of commerce, and the demands on our food stuffs, substitution did not entirely prohibit the rapid increase in prices. Regulation was demanded as consumers' incomes were not at first commensurate with increased prices. Laborers and farmers alike demanded protection. Low prices were desirable from a social standpoint and high prices from an economic standpoint. Recognizing the divergent interests, President Wilson appointed Mr. Hoover as Federal Food Administrator.

Urban Milk Industry.

The problem of maintaining an adequate supply of milk in large municipalities like New York and Chicago has been the subject of much investigation, discussion, legislation, and yellow journalism. Prior to 1917, the interest in municipal milk centered around the sociological rather than the economic phases. Legal enactments demanded the slaughter of all tubercular cows. Sensational propaganda portrayed milk as the cause and carrier of much disease. The tuberculosis question, health regulations, and other phases so adaptable to sensationalism were pushed to the background when the economic aspect became acute in the fall of 1917.

Concentration of Buyers and Sellers.

In most of the cities of the United States, a large part of the milk is distributed by a few large dealers. Twenty or twenty-five years ago the milk distribution was in the hands of a large number of small dealers. Since that time there has been a gradual concentration in the hands of a smaller and smaller number of distributors until in the past few years a relatively large part of the industry has been in the hands of two or three large concerns.

The growth of large distributors made the farmers suspicious that no such industry could be built up unless it was at the expense of exorbitant profits. This suspicion was gradually incensed by the standard prices set by these large dealers which the smaller dealers always followed. Producers felt that competitive prices did not exist and that monopoly price was the natural result of the partial monopoly purchase. The dairymen thus incensed passed through the successive stages of secret organization from local meetings and county organization to the present powerful associations unrestricted by state lines. The latter organizations have become effectual forces for collective bargaining.

The first successful action of the dairymen's organization culminated in the strike in April, 1916, by Chicago producers. New York producers who followed immediately were equally successful. Until November of 1917 they were probably the dominant force in determining prices. At that time the Food Administration interferred and price fixing by disinterested parties followed.

Price Fixing and Milk.

With the advent of the United States Food Administration, milk prices became a mooted question. Unfortunately the Food Administration had no definite policy with regard to the milk question. This vacillating policy produced much dissatisfaction within the industry. The first step was to regulate prices, but unfortunately without serious consideration they contemplated a reduction in prices at a time of the year when prices always increased regardless of the price level. The Food Administration then assumed a "let-alone" policy which however did not last long and was followed by the appointment of sectional commissions as they felt that the question of milk prices was sectional and not national. The commission policy can not be described as successful and with the closing days of the war we find the Food Administration drifting towards some national system similar to that first attempted.

In some sections where policies were unsuccessful, all that economists predicted of price fixing followed. In Chicago production was seriously curtailed. In San Francisco distribution was unsuccessfully tampered with.

After a study of the testimony before numerous commissions, articles, discussions, and conversations, one finds that the price of milk should be based upon: (1) Supply and demand, (2) price of butter and cheese, (3) price of butter and corn, (4) competitive commodity prices, (5) year ratios of feed and labor.

1. Supply and Demand.

The so-called "Law of Supply and Demand" has been advocated by most persons acquainted with the milk situation as the best method of determining proper values. One objection to this method of arriving at just prices is that during periods when surplus milk is availble, buyers may dictate prices without regard to justice. The same may also be said of farmers' organizations during periods of shortage. Under a system of higgling or bargaining over prices there may be more or less continually periods of shortage and surplus during which the farmers and milk buyers will alternately control prices. Consequently producers protect themselves during periods of low price level by decreased production and consumers protect themselves during periods of high prices by decreased consumption. During periods of low price level the metropolitan press is disinterested, but when milk becomes scarce and farmers demand prices in accordance with the ratio of supply to demand the metropolitan press demands "investigation" which reflects back to the farmer, through a larger decline in consumption than would normally have taken place without agitation.

Under normal conditions consumption does not vary widely from season to season or from year to year except as there is a gradual increase in the population. Owing to the fact that the supply of milk is affected by sunshine, rainfall, prices of feed, and many other factors, the immediate market may be temporarily flooded with milk or a pronounced shortage may exist which will materially affect prices while the number of cows has not materially changed. The maintenance of the proper number of cows in the country is more important than an excess or shortage in the immediate supply.

2. Butter and Cheese as a Basis of Milk Prices.

Milk for direct and indirect consumption is produced by the same animal, the dairy cow, but many people do not properly distinguish between the two classes of products. One group, milk for direct consumption, is both bulky and perishable and consequently must be produced approximately as consumed. Milk utilized for indirect consumption in the form of butter and cheese is converted into a relatively non-bulky and non-perishable product which is most economically handled when largely produced in the summer months and stored for winter use. High winter grain costs play little or no part in butter prices, but they are the paramount factor in milk prices. Winter butter prices are normally the summer butter prices plus storage charge. Summer milk prices are approximately summer butter prices, but winter milk prices bear little or no relation to butter. Winter milk prices are more a question of feed. Any system that puts milk prices on a butter basis puts a premium on summer milk and does not take due cognizance of winter feeding conditions.

3. Butter and Corn as a Basis of Milk Prices.

Certain individuals in the state of Wisconsin formulated a method of determining the price of milk for the condenseries of that state. It is briefly as follows: 100 pounds of milk shall be worth the price of the number of pounds of butter fat in the milk, times the Chicago market price of 92 score butter, plus a differential of 6 cents for fat over butter; to this shall be added the value of 85 pounds of skim milk which shall be determined on the basis that 100 pounds of skim milk shall be equivalent to one-half the price of one bushel of corn.

Milk prices for urban centers like New York and Chicago usually are about 50 per cent. higher in the winter than in the summer months, while butter prices are usually but 20 per cent. higher when the same seasonal comparison is made. Corn prices are usually always much higher in the summer than in the winter months. Consequently such a price fixing policy for whole milk based on butter and corn prices puts an added premium on summer milk.

Table 1 presents the percentage variation in the price for Chicago whole milk, butter, cheese and milk on the basis of corn and butter. In the case of butter, cheese and milk, the prices are those that actually existed in the Chicago market from 1908 to 1915. In calculating the price of milk based on corn and butter market the Chicago butter price and the Wisconsin farm price of corn for the period 1908 to 1915 were used.

TABLE 1.—*Monthly variation in the prices of butter and cheese and milk based on Chicago market and upon the prices of butter and corn.*

	Butter.	Cheese.	Chicago Whole Milk.	Butter and Corn
January	109.7	103.6	118.3	104.9
February	103.5	106.7	114.4	101
March	102.2	106.7	106.5	100.2
April	98.9	100.7	93.5	98.7
May	91.0	94	77.1	93.2
June	90.3	93	69.9	94
July	89.6	93.7	83	94
August	91.0	97.5	94.7	95.6
September	96.8	98.3	97.4	101
October	101.1	99.5	107.1	102.3
November	109.0	101.1	115.7	104.9
December	116.1	103.6	118.3	109.5
Average	100	100	100	100

Cheese prices vary from about 93 per cent. in June to 107 per cent. in February; butter from about 90 per cent. to 115 per cent.; milk as sold on the Chicago market varied from about 70 per cent. to about 118 per cent.; milk based on the price of corn varied from about 94 per cent. to about 110 per cent. Such systems of determining prices for whole milk that will not give the proper spread in prices will inevitably fail as they will localize production in the more profitable months.

4. COMPETITIVE COMMODITY PRICE.

The feed and pastures utilized in the production of urban milk can be used in the production of beef, mutton, and to a limited extent the production of pork. Obviously milk prices must follow the prices of competitive commodities, otherwise production will be restricted. Down the ages farmers have had but one method of telling what the public wanted, namely, through price. If wool is high in price and hogs are relatively low business acumen advised farmers that the public wanted more wool and less pork. Although farmers have been advised by well-intending but uninformed individuals to raise more of this and less of that, farmers have been and will continue to be patriotic by following the dictates of the past and produce the commodity that pays best. Consequently, assuming a constant volume of milk is desired, any price system based upon the price of competitive commodities will operate without much injustice to buyers and sellers. Any system of price fixing which does not take proper cognizance of the principles of competitive commodity prices is doomed to failure.

5. Year Ratios of Feed and Labor.

Various branches of the Agricultural Colleges in New York, Connecticut, Rhode Island, Vermont, New Hampshire, Maine, Massachusetts, New Jersey, Michigan, Indiana, Illinois, Iowa and Minnesota have, through investigation, determined the amounts of feed and labor involved in producing 100 pounds of milk. In many cases this work is remarkably uniform while in others there is some disparity. The ratio of winter milk which is produced from barn-fed cattle to the summer pasture milk, the variations in the amount of fat and the method of calculation produces marked differences in cost. It has been unfortunate that these differences have not been brought to the attention of all interested parties as it has tended to reflect upon the preciseness of the work.

The herd cost of milk production involves the production of milk and the young stock reared on the same farms. The cow cost of milk production involves the production of milk from the cows disregarding the young stock. In determining milk prices the two methods will usually give approximately the same results. In contrasting results from different regions and different years the cow cost of milk production is the most satisfactory method.

As you are all aware these costs are expressed in terms of pounds of different classes of feeds and hours of labor. To these are applied the fluctuating values for feed and labor as a proper basis of fluctuating milk prices. Needless to say that a system that will so fluctuate prices should prevent radical changes in the volume of milk. When milk prices are based on these year amounts of feed and labor they should not be uniform, but should vary from month to month. One of the best guides for fluctuating prices of milk is past price ratios. It may be said in general that between the December price of milk and the June price of milk there is a spread of 50 per cent. from the mean year price. Expressed in another way the June price is usually about 60 per cent. of the December price. Again the December price may be said to be about 170 per cent. of the June price. This method of determining milk prices commends itself because the prices of milk will fluctuate with the value of feed and labor and the season of the year and prevent serious injustice; on the other hand, the system is not flexible enough in that it does not take due cognizance of wide fluctuations in milk volume.

One criticism of this method appears in Bulletin 292 of the Wisconsin Agricultural College. The pertinent criticism centers around the following sentence quoted from the above-mentioned article:

"One weakness of the Pearson formula arises from the fact that the price of milk is the major factor in determining the prices of many articles of cow feed." Consequently high prices for whole milk are followed by high prices for the feeds involved in milk production. With this conclusion I can not wholly agree. Turning to Bulletin 629 of the United States Department of Agriculture one finds that all the dairy cows in the United States consume about 8.6 per cent. of the corn, 5.0 per cent. of the oats, 4.4 per cent. of the barley and 23.2 per cent. of the hay.[2] The real significance of the proportions of feed consumed by cows producing milk for urban market to which they apply the so-called formula is understood only when one considers that 15 per cent. of the cows will probably supply that market with fluid milk. It seems to the author that further comment on this criticsm is unnecessary.

[2] Taylor, H. C., Price Fixing and the Cost of Farm Products, Wis. Exp. Sta. Bul. 292, pp. 14–15, May, 1918.

MILK PRODUCTION COSTS.

E. G. Misner,

Cornell University.

The extreme rise in prices during the Civil War period was due chiefly to the fact that they were calculated in inflated paper currency. Similarly, the high prices now are due chiefly to an increased supply of money. Prices of dairy products are high primarily because money is relatively more plentiful than before the war, and not primarily because dairymen or dealers have over-organized, or have become less efficient, or have profiteered; as many persons who use milk and butter are unfortunately led to believe. Feed, labor and cows are high-priced for the same reason. Index figures show that these things, which are the major costs in the dairy business, have increased as much as the prices paid producers for milk and butter. There is no reason for consumers to fear that lately the farmer has been receiving double the former price for milk produced at costs as low as heretofore. Of course, much of the labor in producing milk is by the farmer and his family. But, to be as well-off as before the war they should now receive twice as much per hour as formerly, because money is worth only half as much.

Production Costs in Herkimer County, New York.

During the past summer the writer obtained cost of milk production records in Herkimer County, New York, for the year ending May 1, 1919. Herkimer County formerly was a large center of cheese production, but now some of the milk is shipped to New York City, and most of the remainder condensed, although some cheese is still made during the surplus period. The tendency is to shift to a more intensive type of dairying. A statement of costs for 40 farms appears in Table 1. These farms averaged 142 acres, 70 of which were in pasture land held at an average value of $41 per acre. There were 21.5 cows per farm with an average value of $132 per head. Production per cow was 4,808 pounds of which 33 per cent. was produced during the six winter months October to March. The average yield and the season of production as well as the amount of grain used per cow indicate the leaning toward the summer system.

TABLE 1.—*Cost of producing milk—Herkimer county farms, year ending May 1, 1919.*

Number of farms	40	Value of grain per ton	$61.28
Number of cows	860	Value of silage per ton	7.00
Acres per farm	142	Value of dry forage per ton.	17.84
Acres of pasture per farm	70	Value of manure per ton	2.63
Acres of pasture per cow and accompanying stock	3.24	Average human labor rate, 32.4 cents per hour.	
Value of pasture land per acre.	$41	Average horse labor rate, 19.6 cents per hour.	
Cows per farm	21.5	Cost of milk per 100 pounds.	3.70
Milk produced	41,346 cwt.	Average price received per 100 pounds	2.97
Milk produced per cow,	4,808 pounds	Loss per 100 pounds	.73
Milk sold	38,457 cwt.		
Milk sold per cow	4,472 pounds		
Percent of milk produced April–September	67		
October–March	33		
Average value of cows	$132		

	Amount.		Value.	
	Total.	Per Cow.	Total.	Per Cow.
Charges:				
Grain and other concentrates	833,000 lbs.	969 lbs.	$ 25,526	$ 29.68
Silage and other succulent feed	1,340.9 tons	3,118 lbs.	9,034	10.51
Hay and other dry forage	2,127.4 tons	4,947 lbs.	37,951	44.13
Pasture			9,304	10.82
Bedding			928	1.08
Human labor	165,287 hrs.	192 hrs.	53,495	62.20
Horse labor	37,868 hrs.	44 hrs.	7,406	8.61
Use of buildings			5,011	5.83
Use of equipment			1,808	2.10
Depreciation on cows			7,652	8.90
Interest on cows	$113,735 value		6,824	7.94
Interest on feed and supplies			1,460	1.70
Bull service			3,246	3.77
Miscellaneous			3,778	4.39
Total charges			$173,423	$201.66
Credits:				
Milk and its products used on the farm and milk products sold			$ 9,421	$ 10.96
Calves and calf hides			4,025	4.68
Manure	6,597 tons	7.67 tons	17,350	20.17
Miscellaneous			330	.38
Total returns except milk sold wholesale			$ 31,126	$ 36.19
Difference = cost of milk sold and delivered at station			$142,297	$165.47
Milk sold wholesale	38,457 cwt.		114,284	132.89
Loss on milk sold wholesale			$ 28,013	$ 32.58

TABLE 2.—*Comparison by regions of factors for studying the dairy enterprise.*

State County Year Ending City for which Milk was Produced	New York, Herkimer, May 1, 1919, New York and Herkimer.	New York, Broome, May 1, 1915, New York and Binghamton (Summer Dairies).	New York, Broome, May 1, 1915, New York and Binghampton (Winter Dairies).	Investigations in Michigan, New York, Connecticut and New Jersey.
Number of farms	40	41	56	444
Number of cows	860	503	798	8,810
Size of business:				
1. Number of cows per farm	21.5	12.3	14.2	19.8
2. Hundredweight of milk produced per farm	1,034	645	830	1,283
Labor:				
3. Hours of human labor in milk hauling per cow	192	23	16	195.8
4. Hours of other human labor per cow		163	183	
5. Total human hours per hundred pounds of milk produced:				
Pasture period		2.44	2.84	
Winter period		5.16	3.77	
Year	4.00	3.54	3.42	3.02
6. Hours of horse labor per cow	44	39.1	29.8	45.3
Season of production:				
7. Percent of milk produced in six months:				
April–September	67	71	48	50.3
October–March	33	29	52	49.7
Production:				
8. Pounds of milk produced per cow	4,808	5,255	5,822	6,481
9. Test of milk		4.1	4.0	3.8
10. Pounds of butterfat produced per cow		215	234	244
Feeding per 100 pounds of milk in year:				
11. Grain and other concentrates	20.2	21.7	28.6	33.79
12. Silage	64.9	24.1	96.1	92.2
13. Other succulent feed		13.9	14-7	8.3
14. Hay	102.9	67.2	62.3	43.3
15. Other dry forage		17.2	11.0	10.8
Per 100 pounds of milk in winter				
16. Grain and other concentrates		47.5	42.6	
17. Silage		59.9	151.9	
18. Other succulent feed		10.3	10.2	
19. Dry forage		209.1	118.5	
Per cent of total net cost of milk represented by grain, succulent feed, dry forage and human labor	83.1	78.6	84.9	79.7

*Data for all regions except Broome and Herkimer counties, N. Y., were taken from The Production, Distribution, and Food Value of Milk, a report to Herbert C. Hoover by the Milk Committee of the U. S. Food Administration. Data for Broome and Herkimer counties were obtained by the Dept. of Farm Management of the New York State College of Agriculture.

Grain cost $61.28 per ton; silage was valued at $7 per ton; dry forage at $17.84, and manure at $2.63 per ton. The wages asked by the dairymen averaged 32.4 cents per hour for human time and 19.6 cents per hour for horse time. These are not fancy wages, when drivers of milk wagons in New York City are asking $47 a week. And yet these producers received not 32.4 cents, but instead 15.4 cents per hour of human time after all other costs were met. It is not difficult to see why mechanical milkers or other investments requiring savings are not introduced more rapidly on dairy farms.

How the important factors concerning size of business, labor, season of production, production and feeding for this region compare with other regions is shown in Table 2.

These dairymen have slightly larger businesses than the average dairymen—larger farms, more cows per farm, more cans of milk sold in a year. The labor requirements are about average per cow. One third of the milk is produced in winter, two thirds in summer. Some herds produce three times as much in summer as in winter, others about equal amounts in the two periods. Liberal allowances of hay were used, partly because of the high price of grain, although the common practice is to use less than the average amount of grain. Previous studies have indicated that this extensive system is the cheapest way to produce milk, but in this study only eight farms out of forty, or 20 per cent., showed a profit on cows. The average loss was $33 per cow.

In calculating costs farm-grown feed was charged at its selling value on the farm. Time of the farmer and his family was included at the estimated farm wages necessary to secure other equally efficient to do the work. Hired labor was charged at cost. Interest has been included on the investment in cows and in feed and supplies held for them at six per cent., and on buildings, pasture land, and equipment at five per cent. A common question that arises whenever results of cost studies are stated is, that if the actual loss is equal to the apparent loss, how do such producers remain in business. The answer is that they do one or more of the following things: (1) accept lower wages than the rate at which their time is charged, (2) accept less than farm value for roughage used, (3) accept a lower rate of interest on their investment than the rate charged.

If these farmers received interest on their investment, the farm value of farm grown roughage and all other costs, they then received 15.4 cents per hour for human labor.

If they received 32.4 cents per hour for all human labor and in-

terest on their investment, they then received 40 per cent. of the value of hay and other roughage used.

If no interest is charged on the investment in cows or on land, buildings, equipment, feed and supplies used by cows, and if the farmers received 32.4 cents per hour for human labor, they would still receive only approximately 74 per cent. of the market value of hay and other roughage used.

Low rewards for labor on the farm do not encourage the most efficient and energetic to remain. In the past ten years too many farm boys who would have made good farmers have gone into other higher paying industries, because they foresaw what wages they might expect in farming. The results are apparent, many farms operated by men and women of advanced age; many others for sale. When enough money is allowed to reach producers to reward them as well for time and efficiency as wages paid in other industries requiring equal skill and investment, the business of farming will attract enough of the desirable type of farm boys to properly maintain our agriculture in regions where it is now receding. The pay of farmers should permit them to have modern conveniences for health, education, comfort and transportation. Such conveniences cannot be provided with sufficient rapidity from the savings of low wages, when prices paid for them are based upon labor receiving high wages.

It is too easy to accuse dairymen of inefficiency. The usual methods of attacking the dairymen are to condemn his animals and his methods of feeding and caring for them, without any regard for the food he is contributing per dollar invested or per hour of time spent. As producers of animal products, dairymen are highly efficient. For each hour spent in milk production operations on these farms, there were sold for city use 23 pounds, or over 10 quarts of milk. After other costs were met, therefore, the labor reward of these producers was about 1.5 cents per quart. These 10 quarts of milk contained approximately 6,750 calories of energy. It is said that from 3,000 to 3,500 calories daily are needed to support an average man at moderate work. The average contribution to the city food supply for each 10 hours of work in producing milk on these farms was 110 quarts of milk containing as much energy as required by 23 working men for a day. The daily contribution per farm was as much energy as 26 men require. This must be recognized as efficient business, and calls for none of the adverse criticism that it has received, and will in the future receive, from those whose chief interest is cheap food in the city. The rewards for such contribution should take account of the present and of the more important future necessity of the service.

THE INFLUENCE OF GOOD FARM ORGANIZATION IN COSTS OF PRODUCTION.

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Good organization in farming, as in any other business, has an important influence on costs of production and profits. While it is difficult to separate definitely the influence of good organization from the influence of good operations and other factors, it is nevertheless possible to show how good organization affects production and to measure with reasonable accuracy its influence on costs.

In attempting to determine the influence of good farm organization on production and costs, we can perhaps get a clearer idea of the problem if we study it from the standpoint of the three principal divisions into which farm organization somewhat logically divides itself; *i.e.*, financial or economic organization, physical organization and productive organization.

The financial or economic organization of a farming business is concerned mainly with the problem of determining the minimum size of business which is well adapted to the type of farming to be carried on, and to work out the most profitable distribution of the investment in various items such as land, buildings, machinery and tools, horses and other live stock.

It is evident that if production is to be carried on most effectively, that the various items of investment must be utilized to the fullest extent consistent with the maximum returns for the farm business as a whole. Thus, if the farm is too small the amount invested in buildings, machinery and horses will be disproportionately high. Small buildings are relatively more expensive than larger ones per unit of space for housing live stock, storing feed, or sheltering machinery. A complete outfit of farm machinery needed for the successful operation of a farm in any given region will be adequate for a certain sized farm. This may range for ordinary types of farming from 100 to 200 acres. If the farm is not large enough to utilize fully a complete outfit of such machinery of standard size the costs for this item must be relatively higher than for those farms large enough to make a full use of a complete outfit of standard sized equipment.

In connection with the study of the best adjustment of buildings and machinery equipment, it is important to note that the carrying charge on these items is relatively high and it is therefore important to keep the investment as low as possible consistent with efficient operations. For example, the investment in farm buildings exclusive of the farmer's residence which is a personal item, often varies from $10 to $25 per acre for the same general types of farming carried on under very similar conditions. Apparently both of these classes of farmers have adequate buildings to furnish satisfactory shelter for stock, to store feed, and to house their machinery. If we assume a carrying charge of 15 per cent. a year for interest, depreciation, upkeep, taxes and insurance, for the general run of farm buildings we should have the following results: For a farm with an investment of $10 per acre the total carrying charge would be $1.50 per acre per year. For a farm with an investment of $25 per acre the carrying charge would be $3.75 per acre per year. That is, we should have a difference in the carrying charge, or the cost of production per acre, due to this one item alone, of $2.25 per acre per year.

In the case of machinery the carrying charge is still higher. If we include interest, shelter, taxes, upkeep and depreciation the carrying cost of farm machinery ranges from 25 to 35 per cent. per year. Naturally upkeep and depreciation will be somewhat in proportion to the amount of use, but machinery wears out some, "just by standing around," and also depreciates through obsolescence as well as use. Investments in farm machinery—exclusive of tractors—range from $5 to $10 per acre, throughout the corn belt section. If we assume a carrying charge of 20 per cent. to 25 per cent., these differences in the investments in machinery per acre, would mean a difference in the carrying charge, or the cost of production per acre, of from $1.00 to $1.25.

Cost accounting investigations in Illinois show that such differences in the cost of production due to differences in the investments in both buildings and machinery equipment actually occur on somewhat representative farms.

If we study the physical organization of the farm from the standpoint of its influence on production and costs, we find that it has an important bearing on the problem, particularly from the standpoint of economic operation. In working out the plan for the best physical organization of a farm, we find that the problem divides itself somewhat logically into two parts: *i.e.*, the organization of the farm as a whole, including the location of the farmstead and the general layout

of the field system; and the more detailed planning of the farmstead including the location and arrangement of yards, paddocks, lanes and buildings.

In planning the organization of the farm as a whole the following are perhaps the chief considerations to be kept in mind. The farmstead should in general be so located as to reduce to the minimum the distance between the fields and the farmstead. This applies especially to those fields which are regularly brought into the rotation, and which therefore require the greatest expenditure of time traveling back and forth in raising crops, in hauling crops to the farmstead, and in hauling manure from the farmstead to the fields.

Naturally the average distance to the fields will be determined to some extent by their general shape and arrangement. Ordinarily we should not like to locate the farmstead in the center of the field system where this necessitates having it a long distance from the public road. A good general rule to follow would be to locate the farmstead on the public road as near the center of the field system as possible. Small lots and minor rotation used for growing green forage crops, for hogs and sheep, *e.g.*, should be located near the farmstead to save time in caring for such stock.

In planning the field systems for the major rotation three principal aims are to be kept in mind. (1) There should be as many fields, of as nearly equal size as possible, as there are years in the rotation. (2) Fields should be as large as practicable. Large fields save time in doing farm work and reduce the cost of fencing. (3) Fields should be rectangular if possible, and should be about twice as long as they are wide as a general rule. This makes for convenience and economy in performing the various field operations. Rectangular fields are also more easily and economically fenced than irregular ones.

While many farms present difficulties in the physical organization of their field system which cannot be overcome, one need only to study somewhat casually the organization of farms in going about the country to be convinced that the majority of such farms offer opportunity for improvement along this line. The University of Minnesota College of Agriculture[1] reports that in the re-planning of a 160-acre farm, the average distance from the farmstead to the fields was reduced from 70 to 24 rods, and the amount of inside fencing required from 892 to 640 rods. Illustrations of this kind could be multiplied indefinitely.

We can only touch briefly here on the question of the physical organization of the farmstead. This problem is relatively more im-

[1] Minnesota Bulletin, No. 125, p. 34.

portant on farms producing live stock than on those devoted mainly to crop farming. The entire question of handling live stock with the minimum expenditure of man and horse labor presents opportunities for very important economies. All yards, paddocks, pastures and lanes should be so laid out as to make for the greatest convenience in moving animals from one place to another about the farmstead or between the farmstead and the farm fields.

The location and arrangement of barns, stables, feed storage and general feeding equipment should be so planned as to reduce the man and horse labor required to the minimum. While we have only begun to study these questions somewhat systematically, we already have numerous illustrations of very material labor economies which have been effected through good organization of the physical plant used in producing live stock. Other and more careful studies need still to be made, in order to give us more exact figures regarding the reduction in costs which can be effected in this direction.

Important as are the economies which can be effected through the best financial and physical organization of the farm, it is probable that on a large majority of farms even greater economies can be effected through the more scientific organization of their productive enterprises, *i.e.*, through their productive organizations.

In the organization of the crop and animal enterprises of the large majority of farms with a view to establishing the most profitable and permanent systems of farming, a number of complex and interrelated factors must be taken into consideration. Most important among these, regardless of the order of their importance, would perhaps be the following: The maintenance of the fertility of the soil; the most advantageous marketing of all crop material produced; the best utilization of the man and horse labor used; and the insurance against crop failures, price fluctuations, and other unfavorable conditions by means of a reasonable degree of diversity in producing both crops and animals.

In studying costs of production in agriculture the expense of soil replacement has been almost entirely overlooked. This has been due largely to the fact that farming land has been constantly advancing in selling value, in spite of the fact that it has been almost everywhere gradually decreasing in productive capacity. While it is evident from the economic standpoint that the agriculture of almost every new region must of necessity be extractive, it is equally evident that at some stage in the development of such new regions the point of diminishing returns must be reached. That is, sooner or later it will

pay the operator of such lands better to begin improving or at least maintaining this fertility, rather than to go on farming them extractively. Just when this point is reached it is naturally difficult to tell. It is safe to assume, however, that a great many farmers do not make such changes in their systems of crop production and soil maintenance nearly so early as economic conditions warrant. It is evident both from the standpoint of sound accounting as well as a good farming procedure that the problem of soil replacement must now be taken into consideration in all of the older agricultural regions of the United States in attempting to determine costs of production and profits in farming.

In the working out of this problem several factors must be considered. First, that for general farming the growing of legume crops offers the most economic source of nitrogen, and that the rotation should include the proportion of legume crops necessary to maintain or increase the nitrogen in the soil. Second, that in systems of farming where the crops grown are fed to live stock, and the manure is carefully handled, from 60 to 70 per cent. of the nitrogen, from 75 to 80 per cent. of the phosphorus and from 80 to 85 per cent. of the potassium contained in the crops fed can be returned to the soil. And third, that insofar as the mineral elements in the soil are limiting crop production they should be added in such form and in such amounts as will contribute most to the profits of the entire farm business.

In organizing the productive enterprises of the farm so as to provide the most advantageous market for all of the crop material produced, live stock plays an important part. Regular markets frequently offer very little for damaged grains and other crops, even though they may have almost full feeding value as compared with crops of the best quality.

Much low grade and otherwise waste crop material can be converted into the best quality of live stock products. In fact, a considerable proportion of all crop material produced in a good system of farming has little or no market value. Such low grade and unsalable products can, however, be converted into live stock products by feeding them in connection with the salable crops grown, nearly all of which must in the end be fed to live stock to find a market. By keeping some live stock on all farms growing ordinary crops, it is possible to market advantageously not only the salable portion of the crops grown but also the unsalable and waste portions.

This factor alone eliminates much waste and helps to increase

profits without increasing the cost of producing animals and animal products.

In practically all types of ordinary farming man and horse labor make up from 75 per cent. to 85 per cent. of the total operating expense. A good rotation of crops and the production of two or more kinds of live stock make possible the most even distribution of labor throughout the year. An even distribution of horse labor means that the horses carried can do more work during the year, or that a given amount of work can be performed by a smaller number of horses. Actual cost accounting results on Illinois farms show wide variations in the cost of horse labor. The variations found are frequently responsible for differences of from $1 to $4 per acre in the cost of producing ordinary crops, such as corn, oats, wheat and hay. In just how far these differences are due to good farm organization and in how far they are due good farm operation and other factors it is important to be able to say with considerable exactness. It is plain, however, that they are due mainly to the more efficient organization of the productive enterprises, *i.e.*, the crop rotations and the systems of animal production followed.

The more even distribution of man labor throughout the year, as a result of the best organization of the crop and animal enterprises, makes it possible to find productive employment for practically all of the man labor required at the peak load period. This means that relatively little extra man labor need be hired when labor is scarcest and when wages are therefore highest. It also means that a better grade of man labor can be secured. The best farm laborers will not be contented with a job which does not provide employment throughout the entire year.

Most farmers are working on more or less limited capital. This makes it especially desirable that they organize their productive enterprises in such a way as to offer the largest measure of insurance against crop failure, price fluctuations and other unfavorable conditions. This can be done best by growing several crops well adapted to the region, and by marketing these crops through two or more classes of live stock. In most sections it is also desirable to have at least one cash crop. When several crops having somewhat different seasonal requirements are grown, there is little danger that all will be poor during any one year. When the crops grown are marketed through two or more classes of live stock, the farmer has more choice as to what class of stock he will use in marketing his feed. This is especially true when he does not overstock on animals and when he

keeps his animal enterprises as flexible as possible. Such flexibility in the live stock enterprise is secured mainly by carrying at least one class of animals which can be reduced or increased somewhat from one year to another without too serious disadvantages. Poultry, swine and sheep represent good illustrations of flexible animal enterprises. Horses, dairy cows and beef cows represent the more inflexible forms of animal production. The more flexible or adaptable the system of crops and animal production, the greater measure of insurance will the farmer have against poor crops, violent fluctuations in prices and other unavoidable conditions.

Efficient farming consists mainly in so adjusting the financial, physical and productive organization of the farm as to return the maximum profits for the entire business over a series of years. Each enterprise must be studied from the standpoint of its influence on the business as a whole.

AMERICAN ASSOCIATION FOR AGRICULTURAL LEGISLATION.[1]

RICHARD T. ELY, *Secretary*,

MADISON, WISCONSIN.

The American Association for Agricultural Legislation, organized in Philadelphia, December 28, 1917, has a distinct, well-defined aim differentiating it, on the one hand, from all other agricultural societies, and, on the other hand, supplementing the work of all other agricultural societies. Its purpose, as I take it, is to be the Farmers' Research Organization. Any thoughtful person who has followed with care the history of farmers' movements in this country must see the need of an agricultural society whose aim is scientific preparation for sound agricultural legislation. It should not be regarded as at all presumptuous to say that the American Association for Agricultural Legislation seeks to work out problems of legislation and to help lay a sound foundation for farmers' movements. All that it means to say is that we are endeavoring to apply the well-known principle of division of labor. Nothing is farther from the thoughts of the promoters of this association than to assume any attitude of disparagement towards other farmers' organizations. What we want is to round out and complete the work of other agricultural societies.

Our association has as its function to gather together and render available for specific definite purposes knowledge which has already been gained, but which is general and scattered. It is the intention of the founders to provide an organization in which there shall be combined the best practical knowledge and the broadest historical and theoretical knowledge of the technical problems of production and also of the larger social and economic problems involving both rural and urban people. Heretofore, the agriculturists, the economists and the men of the commercial world have been accustomed to move along separate lines. The agriculturists have not always had the benefit of the best scientific and economic thought. On the other hand, the economists and the business men have not always appreciated the significance of the agricultural problems, while all of us

[1] Paper read before the American Farm Management Association, Baltimore, Md., January 9, 1919.

have often overlooked the common bonds of interest which bind together the city and the country.

The field of agricultural legislation as a field for investigation is largely unoccupied. State and national agricultural institutions are doing much though hampered by limited resources and the conflicting interests to which they are subject. Various voluntary organizations are working in the field of agricultural legislation with varying degrees of success. The field of work is too broad to be bounded in a brief description, but it is obvious that the amount of work which may be done is limited only by the resources which are available. At first comparatively few topics will engage attention and mention of some which are proposed or under consideration will give a fair idea of the work in view.

Specific topics include the questions of legislation on *food production, consumption and price.* How can prices be adjusted so as to promote the proper distribution of capital and labor between rural and urban industries? What basic principles should be adopted and by what methods should they be applied in settling such perplexing problems as the price of milk or wheat? *Is it too much to say that recently these have been questions of life and death?* And should we not now in this period of calm prepare ourselves for the satisfactory treatment of these problems in any future exigency? Is it altogether certain that in times of peace we should not be called upon to take some position with respect to them?

Land settlement involves a group of problems of only slightly less pressing importance. Speculators are working on plans to exploit the returning soldiers and sailors. Every patriotic citizen will recognize the duty of thwarting such designs. At the same time we should use every effort to provide the returning soldiers and sailors with opportunity to become owners and cultivators of the land under conditions which will insure the largest measure of success. Another phase of the question arises out of the unscrupulous exploitation of settlers by speculators. This is a crying evil and is injurious to all legitimate landed interests. Every effort must be made to put the ownership of the land and the business of dealing in land on a high plane.

Land settlements may be made through state purchase and state sales of land to settlers or it may be left to private initiative; and again private colonization of land may be regulated or unregulated. What a host of problems are raised in this brief statement! And the discussions in the press show how unprepared we are for the right solution of these problems, although obviously our practice is to no inappreciable extent dependent upon their satisfactory treatment.

Obviously the pecuniary significance involved in these problems rapidly mounts into the millions if not hundreds of millions.

The word credit brings to mind numerous problems which for their solution require knowledge of experience as well as the best brains that we have. Great is the waste of energy and money involved in unsatisfactory attempts at their solution. Credit is essentially an economic problem, demanding investigation and legislation of the past has not always been based upon knowledge resulting from investigation. We have passed credit laws without investigating the conditions to which the laws apply. In Texas, for example, it is found that an apparently good law has been on the statute books for two years and has produced no results. It is said, on the other hand, that in North Carolina they have passed credit laws with good results because they have had the administrative machinery which is lacking in Texas. Is it not obvious that we should have careful, impartial scientific research in this matter of credit? Does not the private dealer in land need a knowledge, which often he has not had with respect to the length of time which land credit should run, for mistakes in this particular have too frequently led to bankruptcy of land companies and the ruined lives of settlers.

In Wisconsin we now have a county stumping and bonding act with absolutely no results. Obviously a mistake has been made and one which should have been prevented.

We have among us faddist reformers whose schemes may do untold harm unless these schemes are defeated; and calm, impartial investigation is frequently needed to show the falsity of panaceas and easy formulas.

Farmers' marketing organizations present another group of problems. Improvement of the laws relating to coöperative companies, laws relating to the promotion of coöperative companies by professional promoters, and the whole subject of group bargaining on the part of farmers are some of the questions which have been suggested for consideration.

Rural life presents problems vitally connected with the problems of production, marketing and the general efficiency of our entire economic machinery. Maladjustments in rural local government, restricting education and social development, keeping in the hands of the farmer inadequate instruments of social progress, all the while retard his movements whether economic or humanistic. A thoroughgoing analysis of rural life conditions and a readjustment of the farmer's legal human relations to accord with agricultural hope, will, it may be expected, take the farmer out of the class of social protégés

and put him into the class of those who take care of themselves by their own ability to think and act.

These problems mentioned are mere illustrations which could be combined indefinitely.

I have said that we want to gather together and render available knowledge already gained. It is clear from what has been said that we wish to do more than this. We wish to conduct investigations with special reference to legislation, and what we do in this field as in other fields depends upon the funds placed at our disposal. There was a time when some farmers were inclined to sneer at book knowledge, and I can imagine that there are those who will view with some doubt the proposals to let scientific work precede projects of legislation. I am sure, however, that this audience upon reflection will see no more reason why we should not work out scientifically problems of legislation than there is why we should not work out problems of natural science. Broadly speaking, these problems come within the field of agricultural economics—a difficult field, but not one impossible of fruitful cultivation. May I call your attention to one consideration? The officers of this association are, so far as I know, every single one of them practical, as well as men of theory. A good many of them have been or are still successful farmers, and others have practised various arts, like irrigation, closely connected with agriculture. What I can say of myself, I think most of the men in the council of our association can say of themselves. I know what it is to milk cows and to work in the harvest field until it is so dark that one can scarcely see to make the necessary motions and one is so tired that one would gladly lie down in the open field and forget the trials and troubles of the farmer's life.

There is no red tape in our organization. It is a small compact body, representing all sections of our common country, and when we have the necessary money for our work, we can go immediately at any definite problem as it presents itself.

The correspondence coming into the secretary's office shows clearly enough the need of an organization like ours. Help is asked and the requests for help come from widely scattered parts of the country. One problem presented is to work out suitable legislation for land tenure in the open ranges of the arid West. Requests have come in for road legislation to meet the needs of settlers in the cut-over regions of the Northwest. A request has come for suggestions to provide needed credit in regions of Montana, where for the second time an unprecedented drought has occurred. These are illustrations, and it can be seen that it takes some considerable force and time and

money to think out these problems and to make recommendations based upon the best available experience, carefully considered with respect to the definite concrete cases.

As secretary, I receive one class of letters which appear to me to be most promising for the future. These letters come from persons who are seeking office even as high as United States senatorships, or who have already been elected to office. The writers appreciate the importance of the problems of agricultural legislation, and desire to inform themselves so that they may conscientiously perform their duties in public positions. The following is an extract from a letter received from a gentleman who has recently been elected to Congress.

"I have recently been elected member of congress. I am a farmer. I am ambitious to be of real service to my fellow farmers. I want to inform myself regarding proposed and desirable farm legislation. Please advise me how to get in touch with the American Association for Agricultural Legislation, and what to do to receive such literature as that organization has prepared. May I impose on you to the extent to ask of you a list of books or articles that I may secure. I have my own ideas on some of these subjects, and my efforts along those lines are responsible for the preferments that have been given me, when as a matter of personal preference I would much rather remain on the farm. I feel I owe it to myself and my friends to go into these subjects now, more than for mere personal interests. I will appreciate the aid you will give me."

Questions of the greatest importance and questions that will affect the future of the farmers of this country for generations have arisen as a result of the war, and the way that they are treated will affect the farmers of this country for generations to come. This is especially the case as the thoughts of the farmers are plastic just now as they have not been perhaps for generations, and as possibly they may not be again for another generation. *Is it not evident then that the promotion of this association is a service of high order which should appeal to loyal citizens who have an insight into the significance of current events?*

Is there not something tragic in the history of farm organizations in this country? I speak of organizations like the Alliance, the Wheel and others which have perished and also of misdirected efforts of some excellent organizations which are still in existence. The mistakes made seem funny to those who talk about the "rube" and "hayseed," but not so to those who have toiled early and late on the farm. How different would be our situation if these movements in the past had been based upon carefully thought-out plans and had been wisely directed!

It is not easy to exaggerate what can be accomplished by an association like ours. A small body of men grouped together, working scientifically and without any selfish ends can accomplish results which seem almost marvellous. One illustration is afforded by the American Association of University Professors. Less than a score of men belong to the Committee on Academic Freedom, but they have had an influence upon the universities of our country. Perhaps a more pertinent illustration is afforded by the American Association for Labor Legislation, which was organized about ten years ago. During these ten years the Association for Labor Legislation has accomplished more in the standardization of labor laws and in the scientific development of labor legislation than all other agencies combined.

The work of the Association for Labor Legislation has consisted of scientific investigations of facts, careful studies of all existing laws covering a specific matter and consultation with those practically affected by the proposed laws. This has been followed by recommendations so carefully worked out that they have commanded the respect and received the attention of legislative bodies. We believe that an organization of the same type is needed for the advancement of agriculture so far as legislation can advance it.

One aim we have is publication. A great deal of literature already exists in manuscript and more will be prepared which is highly useful, but is not always of a character to be remunerative to the commercial publisher. Publication is one of the aims of our association, and especially publication that helps to solve current problems.

I want before closing to say that our association is not in politics in any proper sense of the term. We do not wish to help any special party, but to promote agriculture.

Our brief history shows that from time to time many of you will feel the need of referring practical problems to a society like ours. To do the work which is our function, we must have a trained office force, even if a good deal of the work is done by committees. We do not hope for such a membership as many other farmers' organizations have, but, I think, we ought to have a membership among the most intelligent farmers and others interested in agriculture of 25,000. We should have an income at least equal to that of the American Association for Labor Legislation which I understand is about $50,000 a year. We want to have some first-class men always on the job, and I believe, as Colonel Mulberry Sellers says, "there are millions in it." Soberly I think it is a great underestimate to say that we are able to promise a return for every dollar given us of a hundred-fold.

PRIMARY VERSUS DERIVATIVE FOODS IN TIMES OF FOOD SHORTAGE.*

HERBERT W. MUMFORD AND ROY H. WILCOX.

A survey of the present and possible future sources of food stuffs of the world reminds us that prior to the war the United States carried the burden of supplying one fifth[1] of the principal world crops and one fourth[2] of the world's meat with which to feed the peoples of her own and other lands. This brings us to the realization that in times of food shortage momentous responsibility for maximum food production rests upon the farmers of the United States. Maximum food production will come only as a result of the most complete utilization of all the agricultural resources of a country. To advocate production of any class of food where such advocacy is unecomonic, is no more unpatriotic nor detrimental than to advocate the destruction and elimination of the sources of such foodstuffs when these sources have a very large and economic place in the agriculture of our country. Such misguided efforts may command attention because striking, but unfortunately they have a tendency to confuse rather than enlighten.

The false impression carried by some, that the action of the British Government in passing the Corn Production Act will in time have to be the action of other peoples as the need for food supplies becomes more urgent, is worthy of careful attention. By this Act[3] "The Board of Agriculture and Fisheries may, if they consider that any land is not being cultivated to the best interests of the country, serve a notice on the occupier requiring him to cultivate it in accordance with their directions. If he fails to do this, the board may, if he be owner of the land, enter on it and take any steps they think necessary for its adaptation or cultivation, all for such time as they think fit."

The purpose of this Act is to bring under the plow grassland suited to the production of wheat and oats. By means of guarantees the

[1] "Geography of the World's Agriculture," by V. C. Finch and O. E. Baker, p. 8.

[2] "International Institute of Agriculture Stat.," Vol. II, February, 1911, No. 2, p. 19.

[3] "Further Provisions of the Corn Production Act 1917," *International Review of Agricultural Economics*, Vol. 84, No. 12, Dec., 1917, p. 75.

* Paper read before the American Farm Management Association, Baltimore, Maryland, January, 1919.

occupier of the land is induced to turn back to wheat or oat cultivation those acres which were earlier forced from grain growing into grass, not because they produced more human food to the nation in grass, but because the low prices of American and Australian grain imports during the last thirty years of the nineteenth century did not allow the British farmer sufficient remuneration to employ the labor necessary to grain raising. The history of American agriculture, in the main, has seen the increase of wheat prices advantageously coming at a time when land was being developed. The histories of the two agricultures are quite different.

The British husbandman found that in laying down more land to permanent pasture he was able to carry a larger number of stock, but out of necessity he was compelled to adopt the policy of permanent pastures due to inability to finance the necessary outlay in tiling machinery and labor.[4] Along with the Corn Production Act the Statutes of the United Kingdom carry an act empowering the Board of Agriculture to interfere should there be the killing of animals to the extent of endangering their supply of breeding stock. The better farmers feel that by breaking up grass, which has lain for twenty to thirty years more stock can be carried. It was the conviction of the members of Parliament favoring the act that in no way should the future of livestock husbandry be endangered, and even by this seeming drastic step in this time of dire necessity for rapid increases in food suitable for direct human consumption it was believed the husbandman, by cultivating these pastures, could greatly increase his forages to the point where he could maintain his stock numbers.

Food conservation is invariably accompanied by substitution and in some instances has given rise to the thought of elimination of certain well-grounded methods of food production. This evolves from the knowledge that equal portions of our improved farm area if sown to selected crops can render in return maximum food energy for the human body.

Dietary studies center about the proper proportioning of individual foodstuffs, though seldom does a dietition overlook the palatability of these foods in the search for heat energy. It is possible to serve either grain or meats singly to the individual until this food becomes repulsive through its inability to longer excite the palate, and it has become a well-established fact that although certain highly clarified grain flours supply the body with the necessary calories they leave it susceptible to diseases caused by the lack of the highly necessary vita-

[4] A. T. Matthews in the *Journal of the Bath and West and Southern Counties Society*, Fifth Series, Vol. IX, pp. 1–13.

mines found in meats and in the portion of the grain heretofore discarded or used for stock foods.

Doctor Edward B. Vedder, captain in the Medical Corps of the United States Army, writing in the *Journal of the American Medical Association* (Vol. 67), says that the "Articles, namely, flour, cornmeal, canned goods and salt meat, which have been demonstrated to produce deficiency diseases should be supplemented with white potatoes and fresh meat, known preventives of deficiency diseases, and that these preventive foods should be served at least once a week, and preferably once daily."

The Committee on Nutritional Problems of the Food and Drug Section, American Public Health Association, in their report of October 14, 1918, advise that: "There is nothing more important in the whole problem of food supply than that the purchase of market milk be fully maintained in order to prevent any depletion of the dairy herds. A liberal use of milk in the diet is the best safeguard against any deficiency which might possibly arise through restricted choice of foods, and the safest way to ensure that the consumption of enough food to maintain a normal weight for the height and age, shall meet all other requirements of nutrition as well."

At the outset of this discussion let us get the idea in our minds that our problem is to produce the food that is needed. It is not to produce livestock to the exclusion of farm crops or to produce farm crops to the exclusion of livestock. Our problem is to obtain and maintain the right economic balance between livestock and grain production. It is essential that we strive to maintain our grain supply, but it is none the less important that we guard against the interruption of our large agricultural enterprises in other direction or against unduly unbalancing our agriculture by undertaking to do things which are not desirable from a physical point of view and which are foreign to the habits of our farmers.

The family budget may be considered as safe as any criterion that might be applied to determine the true economic balance between livestock and grain production. From data compiled from the family budgets of 2,567 families in thirty-three states whose breadwinners earned not more than $1,200, the Bureau of Labor (Bul. 54, p. 1162) found that of the total, family disbursements were divided as follows: 42.54 per cent. for food, 14.04 per cent. for clothing, 12.95 per cent. for shelter, 4.19 per cent. for fuel and 26.18 per cent. for sundries. Of the disbursements for food 55.46 per cent., or substantially more than one half, was spent for meat. The next items in order were 9.72 per cent. for potatoes and other vegetables, 8.96 per cent. for

bread, flour and meal, 5.33 per cent. for sugar and molasses and 5.05 per cent. for fruit.

Or as Mr. Charles J. Brand puts it in the *Journal of Industrial and Engineering Chemistry*, January 18, 1918, "Roughly speaking the diet of the average person in the United States is obtained from the following sources: 39 per cent. animal, 31 per cent. cereal, 25 per cent. fruits and vegetables, and 5 per cent. sugar, condiments, and miscellaneous. On account of the inroads that the war has made upon the herds and flocks of the world, it has been estimated that there has been a decrease of over one hundred million head of cattle, hogs and sheep. Although our own animal production has been increasing slightly during recent years after a long period of serious decline, it has not kept pace with the increase of population to say nothing of our growth in exports of meats. The average exportation of meats during three years preceding the war was something over 493,000,000 pounds. During the war, a year extending from July 1, 1915, to June 30, 1916, the exportation was almost 1,000,000,000 pounds. It is of course impossible to increase animal production quickly enough to produce this requirement. Hence conservation must be called upon in order to provide what is needed."

If any one will count up the various resources of the nation available for livestock production, he will discover two things: first, that there is a vast area of land and an enormous quantity of feed that can be used in no other way; and second, that when this nation has extended its grain production to the limit there will be some land and a great deal more feed that can be used in no other way than in livestock production.

Wheat is our most important human food cereal. This crop prior to the war occupied only 5.14 per cent.[5] of our farm area. All cereals which under extreme conditions might be used for direct human consumption occupy but 21.77 per cent.[6] of our farm area. After accounting for cotton and miscellaneous crops the balance, or approximately 72 per cent. of our area is used for grazing and for hay and forage crops, either permanently or in the necessary farm rotation the land and crops which under present conditions lend themselves naturally to livestock production. The present relation between the areas in those crops suitable for direct human consumption and those now used to produce human food by means of livestock is not fixed and in times of continued food shortages will necessarily change.

[5] U. S. Census, 1910, Vol. V, p. 590.
[6] U. S. Census, 1910, Vol. V, p. 532.

Certain investigators attempt to show that the final uses to which the land of the United States will be put will be about as follows:[7]

	Per Cent.
Agricultural land	51
Grazing land	26
Absolute forest land	19
Intermediate between agricultural and forest land	2
Barren land	2

Other investigators place 62.7 per cent.[8] of the total land area of the United States as suitable for agricultural purposes with at least 19 per cent. of this not agriculturally useful yet always available.

Although it is possible to ultimately crop between 50 and 60 per cent. of our land area it must be remembered that in the meantime there are millions of acres of land which, though potentially tillable are not profitably tilled, still much of it can be profitably used in the less intensive way of grazing livestock. The last census shows only 25.1 per cent. of the total land area improved and in farms. To double this it will be necessary to drain much of the wet land, to irrigate much of the dry land, and to use for grazing in the meantime much of the untilled marginal land that some day may be profitably tilled. If the area in cultivation were increased to the highest possible state of intensity there would be a decrease in the amount of land available for pasture, but there would be an increase of available food for livestock production which would more than offset the decrease in land. The larger the production of grain the greater the volume of grain suitable for livestock production and the more roughage there will be available. This all goes to show a very evident need of livestock, not only to supply the needs of the world population, but at the same time to conserve the by-products of agricultural production. Since a large area of this country is agriculturally useful, but still not suitable for cultivation, since this country produces grain far in excess of human consumption, livestock production can be increased without seriously absorbing our grain supply.

Though it may seem trite to say that a well-organized and administered business means the complete utilization of all factors of production and the profitable disposition of all the products and by-products in agriculture, this situation scarcely ever exists. On a farm which produces grain alone, the land, the horse and man labor, and the equipment are idle for a large part of the year, while the cost of

[7] Circular 159, Forest Service, U. S. Department of Agriculture, pp. 4-15.
[8] U. S. Department of Agriculture, Crop Report.

maintenance, the taxes, and the interest on the investment apply the whole year. On this type of farm even though it carry a heavy investment in labor saving machinery there is normally crowded into two or three months, at the high peak loads,[9] the necessity for as much man labor as is needed throughout the remaining nine or ten months. An agriculture resting upon such a foundation cannot "regard the future with confidence and hope."[10]

A system of agriculture in which the right economic balance is maintained between livestock and grain production is one in which a high percentage of the by-products are utilized and converted into marketable commodities for human consumption. Chief among these commodities are stover, straw, leguminous roughages, and hay, a considerable amount of which will always be grown. The oil meal products of cottonseed and linseed seem to be on the increase. Wheat bran and middlings as by-products of our flour mills run up to vast totals as do also the by-products of the various corn products. In speaking of these sources of food as by-products we too often pass them by without really obtaining a comprehensive knowledge of their value even under present conditions. The fact that they do not easily lend themselves, even under extreme necessity, to direct human consumption does not in the least lower their value as sources of meat production. There are 245,253,000[11] tons of stover produced annually. This stover contains 30 per cent. of the meat-producing power of the corn crop. Then, there are 120,000,000 tons[12] of straw annually, only 54 per cent. of which is used for feed now. These roughages always accompanying the grains are often destroyed under grain systems of farming or when left on the land are a wanton waste of food energy. I question any food policy, attempting to relieve in a time of food shortage, which sets aside any roughage or by-product that supplies 30 per cent. of the meat-producing power of our corn crop—a policy which disregards our corn stover, of one and one half times more value in its capacity to produce meat than the present oat, barley and rye crops combined. This by-product, if siloed and fed in a ration with nothing else than one pound of cottonseed or linseed oil meal[13] daily, will maintain forty-five million cows during six months of the year, and will bring them through in good physical

[9] U. S. Yearbook 1911, p. 278.

[10] "Agriculture After the War," A. T. Matthews, *Journal of the Bath and West and Southern Counties Society*, Vol. XI, p. 14.

[11] *Weekly News Letter*, September 12, 1917, p. 4, U. S. D. A.

[12] Monthly Crop Report, May 10, 1915, p. 5, U. S. D. A.

[13] Unpublished work of Professors Rusk and Grindley, of Illinois University.

condition, while they are furnishing at the same time a full and normal calf crop. As this stover is all found, and will have to be fed, in the corn producing territory, these forty-five million cows can be carried the remaining six months on the twenty million[14] acres of legumes now planted for nitrogen fixation and used principally for forage crops, together with the unimproved acres in the farm area and on some of the eighty-five million[14] tons of leguminous hays produced annually.

Every year there is a certain proportion of grain that is damaged, grain not fit for human consumption. In 1915 about 14.4 per cent. (146,000,000 bushels) of the total wheat crop[15] was unmillable. Ordinarily 5 per cent. (135,000,000 bushels) of the corn crop it not fit to husk[16] and in 1917 only 72 per cent. of the total crop was fit to husk. A certain amount of grain is harvested and shipped yearly which is in such poor condition and of such low grade that it cannot pay the expense of shipment. Under systems where no livestock exists these grains constitute a loss which in times of food shortage is not justifiable. Experience with the corn crop of 1917 convinces the farmer of the United States it is unsafe to be found without hogs, cattle, sheep, or the dairy cow to insure against a loss from immature grain, much of it unfit even to harvest unless by livestock.

I do not wish to tire you with statistics, but we cannot overlook the vast store of energy in the by-products of the mills, factories and oil presses. There are 2,000,000 tons[17] of cotton seed meal, and 1,012,088 tons[18] of linseed oil meal annually to combine with farm roughages and grains, or with grass in fitting livestock for the winter or for market. There are over a million and a half tons[19] of cotton-seed hulls. The by-products of wheat milling normally exceed[20] in quantity all the small grains fed on the farm. Besides supplying the outlet for surplus corn and grain, livestock is necessary to the best utilization of the by-products of agricultural commerce.

[14] Price Current Grain Reporter, Statistical Annual 1915, p. 75, and 1916, p. 79, and the U. S. D. A. Crop Reporter, October 17, pp. 96–101.

[15] Rosenbaum Review, May, 1917, p. 7.

[16] U. S. D. A. Monthly Crop Report, Nov., 1917, Vol. 3, No. 11, p. 110.

[17] U. S. D. A. *Weekly News Letter,* Vol. II, No. 11, and Vol. III, No. 32, and *Commercial America,* September, 1915, Vol. XII, No. 3, p. 9.

[18] This amount is exported. U. S. D. A. *Weekly News Letter,* Vol. II, No. 11, and Vol. III, No. 32.

[19] Figures for 1913 show 1,564,000 tons. *Commercial America,* September, 1916, Vol. XII, No. 3, p. 9.

[20] 222,523,093 bushels of grain ordinarily fed or 63.5 per cent. barley, 39.2 per cent oats, and 12.7 per cent. wheat. U. S. D. A. Farmers' Bulletin, No. 629.

Since the chief object of farming is to produce food and clothing material and since after the human needs have been satisfied, under pre-war conditions, the residue of the farm crops left on the farm have included in addition to vast quantities of roughage, 80 per cent. of the corn crop, 63.5 per cent. of the barley, 39.2 per cent. of the oats, and 12.7 per cent. of the wheat,[21] there is a very evident need of livestock to utilize to the fullest extent these products. Ours is notably a meat and corn eating population, with corn on the one hand most used under dire necessity, meat on the other indicating greater ability to earn the substantial things of life. If under normal conditions it became necessary to forego marketing this corn crop to the workman in the form of meat and give it to him in the original state it would without question indicate the lowering of the standard of living.

Though the production of food is the most important function of the livestock industry, it is not the only one. These are manufactures which utilize the excess fat, blood, bones, skins, hoofs, hair, and all other parts. Industries, subsidiary to the meat packing industry, which are producing supplies for which there is an increasing demand, have been developed. Notwithstanding the fact that slaughtering increases the value of the product by about 14 per cent. the packers are able to sell the animal's carcass at a figure which is below the purchasing cost. The explanation of this lies in the profit returned from the by-products of the meat packing industry.

Hides and skins form one of the largest single items of manufacturers' materials imported, their value in the fiscal year 1917 having been 216 and ⅓ million dollars against 57 and ¾ million in 1900, an increase of almost four times during the seventeen years. The increase in quantity, however, is much less than that in value, from 346 million pounds in 1900 to 700 million in 1917, a gain of nearly 100 per cent. in quantity as compared with an increase of 275 per cent. in value. Hides and skins seem likely to continue to be an extremely important factor in the import trade. In 1900 hides and skins of foreign origin constituted about 36.7 per cent. of the national supply, in 1910 about 26.1 per cent. and in 1915 about 32.8 per cent.

Without going into detail concerning the wool supply, it can be stated that the situation is about the same as with the leather. The peculiar demands for wool incident to the war are such that the United Kingdom which supplied the United States with 38,897,503 pounds of wool for the manufacture of clothing in 1915 has found it

[21] U. S. D. A. Farmers' Bulletin, No. 629.

impossible to ship more than 1,555,182 pounds in the year ending June, 1917, a decrease of 96 per cent. The latest statistics (1915) show that the United States has each year drawn a larger percentage of her wool supply from foreign sources until now her home production is but 35 per cent. of her consumption.

A careful and conservative estimate shows that the barnyard manure produced by the farm animals (horses, mules, milch cows, beef cattle, sheep, and swine) of the United States if properly conserved and applied to the soils of this country would have a value equivalent to increasing yearly our corn crop by 674,000,000 bushels, our wheat crop by 329,000,000 bushels and our clover hay by 23,300,000 tons. It is probable that at present less than one fourth of the barnyard manure of the United States is properly conserved and applied to the soil. If three fourths instead of one fourth of this barnyard manure could be conserved and applied to our lands, and I believe it could, we would thereby increase the value each year of our farm crops equivalent to 337,000,000 bushels of corn, 165,000,000 bushels of wheat and 11,700,000 tons of clover hay.

Attention should also be called to the fact, that in addition to barnyard manure, farm animals furnish considerable quantities of fertilizers, known as packing-house by-products, such as dried blood, dried meat, tankage, hoof meal, horn dust, hair, leather meal, wool waste, raw and steamed bones, bone black, bone ash, etc. Surely a tremendously significant resource for food production which should be mobilized and intelligently utilized.

It is high time we changed our point of view and our attitude toward the whole livestock industry from looking upon it as destroyer to that of a conserver of human food in its proper place just as essential, just as economic as cereal production. Where necessary, practice must be changed to conform to this new order of things. The sooner this is done the sooner a constructive program of livestock production can be courageously and vigorously pursued.

A permanent agriculture must be a profitable agriculture—a profitable agriculture for all people, not forgetting those who are not favored by having a highly fertile, unbroken acreage, all of which can be profitably employed for the production of cereals. I repeat, a permanent agriculture, a permanently profitable agriculture is inseparable from rational systems of livestock production.

METHODS OF MAINTAINING FERTILITY ON SUCCESSFUL NEW JERSEY FARMS.*

FRANK APP,

NEW JERSEY AGRICULTURAL EXPERIMENT STATION.

Agriculture in New Jersey is more highly specialized along clearly defined types than that of many states. This is due to three primary factors: viz., soils, markets and climate. Each type of agriculture has a system of maintaining fertility which has been developed by years of experience and farm practice. The most important types of agriculture in the state are the following:

Dairy	General
Potato	Poultry
Truck	Fruit

Of these six types only the first four will be discussed in the paper.

DAIRY—NORTH JERSEY.

The most extensive and clearly defined dairy farming exists in North Jersey upon soils of Glacial origin. The retreating glacier left a sheet of till consisting of clay, sand and gravel, deposited by streams issuing from the ice sheet. Much of this till is quite thin, so that the existing soils are the result of the disintegration of the underlying rock. The underlying rocks of this area consist largely of shales, slates, sandstones, gneissic and limestone rocks. The topography is rolling to rough, which furnishes an abundant amount of cheap pasture and hay land. About one third of the farms are tilled with the remainder of the area in pasture and rough, stony land.

The dairy farms in this soil province have an average of 20.3 cows on the owner farms and 26.3 cows on the tenant farms. Ninety per cent. or more of all the receipts were from milk and livestock products. Consequently, practically everything which was sold from the farm left it in the form of milk. The purchase of plant food through the purchase of feed for the cows, and the sale of milk shows an income and outgo of plant food. The sale of market milk from the farm is sometimes said to be exhaustive of the fertility. Practically

* Paper read before the American Farm Management Association, Baltimore, Maryland, January, 1919.

all the crops raised, 90 per cent. or more, were fed to the cows and other stock, while much feed is purchased, namely, 2,227 pounds per cow on the owner farms, and 2,160 pounds per cow on the tenant farms.

TABLE I.—*Amount of plant food bought in feed and fertilizers and sold in milk on 460 dairy farms of Sussex County, New Jersey.*

Item.	Pounds.	Nitrogen, Pounds.	Phosphoric Acid, Pounds.	Potash, Pounds.
Concentrates	27,282,000	804,819	447,424	196,430
Fertilizer	514,000	10,280	41,120	51,400
Total	.....	815,099	448,544	247,830
Milk	68,673,550	315,898	147,648	117,431
Balance	.....	449,201	340,896	129,399

By taking the quantity of feed purchased, the amount of plant food obtained through feed can be reckoned. Deducting from this the amount of plant food sold in the milk, we find the balance of the plant food left for the farms. According to the data, these farms should be growing more fertile in spite of the small amount of fertilizer purchased. Less than one half as much plant food is sold in the milk as is purchased in the feed and fertilizers. However, much of this purchased plant food obtained in the feed is lost because the manure is not all applied to the growing crops. Some is lost in the pastures, and some is lost by poor care. Yet there would still be a large balance in favor of the purchase of plant food. By the judicious use of a little fertilizer with proper tillage, far better crops could be produced. Dairying as followed on these farms should increase fertility. These farmers are skilled dairymen, but not skilled in the production of crops. The money is made from cows, and not from crops. As a consequence, their methods of maintaining fertility on these farms as a whole are not admirable. They have more manure for their crop acres than is efficiently used. This is quite evident when we consider that 2.9 crop acres per cow were found on the owner farms and 2.7 crop acres per cow were found on the tenant farms. Most of this manure was applied to the hay land. Some was applied to corn and other grain, which is raised as feed for the cows. However, the more successful of these farms are adopting a shorter rotation, allowing hay to remain down two years or three years at the most, raising more corn, more small grain, and buying acid phosphate as a supplement to their stable manure.

The county agent during the last few years has shown, through his demonstrations, that there is no element so badly needed on these farms as the application of acid phosphate in connection with stable manure for the crops grown on these dairy farms. Thus, by shortening the rotations, growing more corn and small grains, larger crops were produced at a comparatively small expense, with considerable profit to the farmer. We might say, that the farms as a whole in this rotation maintain their fertility and crop yields by the purchase of almost no fertilizers, while successful farms purchase some fertilizers, most of which is acid phosphate, to supplement their stable manure. The following crops were raised on these farms: grass, corn, oats, rye, buckwheat and wheat; also some potatoes and truck.

Dairy Farms—Central Jersey.

The second and less highly specialized dairy industry of the state is located upon the red shales of the Piedmont Plateau province. This area is more tillable, has less stony, rough land, and is less rolling in topography. Because of this, 24 per cent. of the farm receipts are from crops and most of the remainder from cows.

A shorter rotation, consisting of corn, oats, wheat and grass (clover and timothy), one to three years, was used. These farms had an average of 13.1 cows, 4.3 horses and other stock, making an equivalent of about 20 animal units, and 75 crop acres. Approximately ten tons of concentrates and five tons of fertilizer were purchased per farm. The most successful farms having the best crop yields applied *45 per cent. more fertilizers per acre,* besides the usual amount of manure. These more successful farms usually had a shorter rotation, allowing grass to remain but one year and grew more grain. The writer, unfortunately, has not had the opportunity to determine the balance of plant food elements, but there probably is a balance in favor of the farm.

Potato Farms—Coastal Plain Soils.

The most highly specialized potato industry is located on what is known as the Sassafras loam soil of the Coastal Plain area. The surface soil consists of a brown mellow loam eight to twelve inches deep, while the subsoil ranges from a yellowish brown to reddish yellow heavy loam to silty clay loam. At a depth of twenty-eight inches or more, considerable sand and coarser material is found in the substrata. Other soil types of this coastal plain area grow potatoes, but not so well. Still, many are grown on the lighter, more sandy soils.

Crops.—No definite system of rotation is followed on these potato farms. Wherever some system is practiced, the rotation may consist of potatoes one or more years, hay one or two years, and corn one year. Another system which is quite largely used consists of potatoes one or more years, rye or wheat one year, hay one or two years, and corn one year. Again, others attempt no rotation at all, and crop potatoes on the same area for an indefinite period. In such a case, corn, rye or wheat, and hay, may be rotated on other fields. However, the custom of raising potatoes continuously on the same area appears to be growing, and this practice restricts the potato area from the rotated portion of the farm. This is comparable to the use of alfalfa on most of the farms in other regions. This area, for the time it is occupied by the potato crop, is thrown out of rotation as long as the crop is successful. It is not uncommon to find a portion of the farm growing potatoes continuously, while in another part potatoes are used in a tentative rotation with corn, rye or wheat and hay. While this system appears to militate against all rotation principles, both from the standpoint of agronomy and farm management, yet these farms are very successful in maintaining their potato yields and in handling their labor economically. Thus it is a system peculiar in itself, but apparently adapted to the conditions as described in this area.

Farm Practice.—The farm practice of these farms is unique, as we would expect in such a type of farming. In many respects individual practices differ, but the method of handling the potato crop is uniform.

The basis and means of maintaining such an intensive industry depend to a large extent on the universal use of cover crops and fertilizers. There is no area in the State where cover crops are given such careful attention as on these potato farms. Much of the success of these crops is due to the large residual fertilizer application from the potatoes. Successful cover cropping needs fertile soil the same as other crops. It is only through this practice that the farmers are able to maintain soil fertility. Wheat, rye and crimson clover are the most common cover crops. But some crimson clover is seeded alone, at the rate of a peck or a half-bushel to the acre. Others use 1½ to 2 bushels of rye, while many use wheat. A large number combine crimson clover with rye or wheat, using 4 to 8 quarts of crimson clover with 1 to 1½ bushels of either rye or wheat. This makes a better cover crop because of greater growth of the wheat or rye, combined with the value of the clover in adding nitrogen. Furthermore, the rye or wheat protects the clover so that it will live through the

winter more successfully than if seeded alone. Some of the larger growers who do not finish digging until quite late, omit the clover and use only rye or wheat, since the late season allows for little development of the former. Therefore, to some extent the time of digging influences the nature of the cover crop used. For the latest seedings rye is more commonly used since it is more hardy than wheat and will give a more satisfactory cover when seeded late. Wheat appears to be more popular for the earlier seedings. It makes a more leafy growth, and if the spring plowing is delayed, it does not make such a rapid growth in the spring. Some of the fields will not grow crimson clover successfully, probably because of need of lime. Though this clover will stand a certain amount of acidity, it will eventually be driven out of acid soils.

Thus at a cost of $2 to $6 per acre for cover crop seed, together with the use of chemical fertilizer, it appears possible to maintain the organic content of these soils and keep them productive for continuous cultivation of potatoes.

This system is independent of the use of livestock which is almost universally looked upon as necessary in maintaining fertility. Neither do these potato growers, as a rule, buy or apply manure as is frequently the custom among truckers.

When potato ground is seeded to rye or wheat it is not necessary to replow, but merely to prepare by harrowing and to seed the crop. This makes it economical in the use of labor as well as in the use of fertilizer; unless the potato ground is quite light, sufficient residual fertilizer will be left after the potatoes are dug to grow the rye or wheat without additional application of fertilizers. Sometimes grass for the next year's hay is seeded after potatoes, without plowing, but by preparing with the harrow only, in the same manner as for the seeding of alfalfa.

On some of the lighter sandy land, cowpeas are seeded, plowed under and the area seeded to rye. Yields on such areas are low, yet considerable straw is produced. Hay is ordinarily left in the rotation one year only. On these light soils it is not profitable to allow a field to remain in grass after the clovers have died out.

Fertilizers.—The potatoes are given the major portion of all the commercial fertilizers purchased. This is an important charge against the crop, for the application is heavy. The usual amount is 1,200 to 1,800 pounds per acre. This usually is applied in the row at the time of planting the potatoes. In this way labor is saved over the separate application as followed in some potato-growing regions. The rye is lightly fertilized when it does not follow potatoes. On the lighter

soils fertilizer is used at the rate of 200 to 400 pounds per acre for rye. Corn is frequently fertilized at the rate of 300 to 500 pounds of commercial fertilizer per acre. On the corn much of the manure obtained from the stock is applied. The grade of fertilizer most commonly used at the time of the survey was one showing an analysis of 4–8–10, *i. e.*, 4 per cent. of nitrogen, 8 per cent. of phosphoric acid and 10 per cent. of potash. Recent experiments of the New Jersey Agricultural Experiment Station show that a 4–8–5 potato produces larger yields than more or less potash. These results appear to agree with recent farm practice.

The fertilizer used for the corn was usually a 2–8–10, now a 3–10 or 4–10, or some potato fertilizer, and the same is used for rye. A very limited amount of top dressing for hay is practiced, nitrate of soda being used frequently for the purpose.

Plant Food Balance.—These men grow almost nothing but potatoes as a cash crop. Consequently, it is an easy matter to reckon the balance of plant food as they apply it in the form of commercial fertilizer and sell it in the form of potatoes and other farm crops. To show the plant food balance, the following table is representative of the successful potato farms on these soils.

PLANT FOOD BALANCE ON 40 MONMOUTH COUNTY POTATO FARMS, NEW JERSEY.

TABLE II.[1]—*Plant food removed by crops and through purchased fertilizers and manures on 40 successful potato farms of New Jersey.*

Crops sold.	Amount, Tons.	Nitrogen.	Phosphoric Acid.	Potash.
Potatoes	9186.7	31.23	14.69	53.28
Corn	54.2	.89	.38	.30
Wheat	52.0	.98	.28	.45
Rye	158.4	2.86	1.36	.91
Hay	285.0	3.39	.76	4.41
Total plant food sold		39.35	17.47	59.35

TABLE III.[2]—*Plant food purchased in fertilizer and manures on 40 successful potato farms of New Jersey.*

Kind.	Amount, Tons.	Nitrogen.	Phosphoric Acid.	Potash.
Commercial fertilizer	987.16	39.48	78.97	98.71
Stable manure	115.00	.57	.28	.57
Total plant food purchased		40.05	79.25	99.28
Total plant food sold		39.35	17.47	59.35
Difference		.70	61.78	39.93

[1] Analysis Henry's "Feeds and Feeding," pp. 582–585.

[2] Fertilizer 4–8–10. Manure $\frac{1}{2}$–$\frac{1}{4}$–$\frac{1}{2}$. Labor income, $1,224.

It is quite striking from this table that practically as much nitrogen purchased in the form of commercial fertilizers is sold in the form of farm crops. The major portion sold is represented in the potato crop. However, less than one third of the phosphorus applied in the form of commercial fertilizers was sold from these farms, while a little over one third of the potash was sold in the form of farm crops.

Livestock.—The addition of livestock on these potato farms did not increase the fertility, or materially decrease the cost of fertilizers. The following data show the influence of livestock on the potato yields and the fertilizer cost per acre.

TABLE IV.—*Relation of livestock to yield and fertilizers; cost in 1914–15.*

Stock Receipts Per Cent. of Total.	No. of Farms.	Crop Acres for Each Productive Animal Unit.	Acres of Potatoes.	Other Crop Acres.	Potato Yield per Acre.	Fertilizer Cost per Crop Acre.
5 per cent. or less.	63	20.9	30.9	44.4	86.7	$10.60
5.1–10.....	63	14.8	27.9	49.1	81.4	9.10
10.1–20.....	44	11.7	22.4	44.4	80.2	8.90
20.1–30.....	13	9.2	19.3	53.1	78.3	7.30
30.1 and over	11	5.8	17.9	42.8	73.2	9.60

The statement that livestock is essential to maintain fertility in extensive farming is not borne out by these figures. In fact, the farms with the smaller proportion of livestock are producing greater acre yields than those more heavily stocked. There is a consistent decrease in yield as the proportion of stock increases.

The amount of fertilizer purchased per crop acre is somewhat greater for those with the smaller proportion of livestock. But these farms, too, have a larger proportion of the crops in potatoes. As the major portion of the fertilizer is applied to the potatoes, it is evident that the more heavily stocked farms are using less fertilizer per farm, but more per crop acre of potatoes. This might indicate that the stocked areas are on poorer soils, but this does not appear to be the case. From these data it appears that a system of potato farming with green manures and commercial fertilizers is more efficient in maintaining and increasing fertility in this area than in the use of livestock. The lightly stocked farms purchased about seven tons of fertilizer more than those heavily stocked. These seven tons of commercial fertilizers, applied with the green manure cover crop, apparently is of more value in adding fertility than are the extra 6.9 animal units on these farms. It is merely a question of balancing one practice against another in maintaining fertility and production on the farm. In this case livestock apparently was not equal to commercial fertilizers and green manure cover crops as they are used in the area.

General Farms—Coastal Plain Soils.

Soils.—The soils of this area are largely loams, gravelly loams, clay loams, and sandy loams, and are better adapted to corn, small grain and grass than are the Freehold soils. Areas of sandy soil are found on some farms, giving a wide range of soil conditions. While some of these soils are adapted to potato growing, they are not so well suited for potato production as the Freehold soils.

Crops.—The principal crops in this vicinity are corn, grass and rye. Potatoes hold an important place on some farms, while wheat, fruit, and truck and a few miscellaneous crops are raised.

Farm Practice.—The rotation on the heavier soils consists of corn, one year; rye, one year; and grass, two or three years. Where potatoes can be raised the rotation is corn, one year; potatoes, one to three years; or rye, one year, and grass, one to three years. Frequently the area following corn is cropped part to potatoes and part to rye. The rotation is thus elastic and can be made to fit the needs of the farm and soil. On a few farms the operators follow a double rotation by growing corn, rye and hay on their heavier soils; and corn, potatoes and hay or corn, potatoes, rye and hay on their soils best adapted to the potato. After corn, a field is usually seeded to rye; the part of the field best adapted to potatoes is plowed (the rye being used as a cover crop) and planted to potatoes. In brief, then,—corn, rye and hay are the regular rotation crops, with potatoes planted on the part of the field or farm best suited to them. Occasionally on the sands and loamy sandy soils, cowpeas are seeded after rye harvest and plowed under in the fall; the field is reseeded to rye again and then to hay one year, followed by corn.

When potatoes are cropped for several years continuously on the same area, cover crops are used very similar to those of the Freehold area. These usually consist of rye, wheat, crimson clover or a combination of rye or wheat and crimson clover. However, the use of cover crops is not so prevalent or so well developed on most of these farms as on the potato farms in the Freehold district.

Fertilizers.—Stable manure is usually applied to the corn ground and commercial fertilizer is used on rye, potatoes and corn. The potatoes received 1000 to 1600 pounds of commercial fertilizer per acre. This was a 4–8–10 grade, now a 4–10–0 or 4–10–3 to –5. During the abnormal conditions caused by the war, the amount of potash has been decreased or omitted. The corn received 300 to 400 pounds of potash fertilizer of a cheaper grade, such as 2–8–7, now a 3–10. Rye received much the same fertilizer treatment as corn. When fol-

lowing potatoes, rye does not always receive fertilizers. While the fertilizer practice is not so well standardized as in some parts of the county, still the same practices prevail over much of the area. Wide differences in soils exist on these farms, making different fertilizer treatment as well as different cropping necessary.

Livestock.—These farms wherever truck and the lighter soils prevail, maintain their fertility largely through the use of cover crops, the same as the potato farms. However, the heavier type of soils are more inclined to keep livestock. The following tables will illustrate the effect of livestock upon the fertility of these general farms.

TABLE V.—*Relation of livestock to crop yields and fertilizers purchased on 260 general farms in Monmouth County, New Jersey, in 1914–15.*

Receipts from Livestock; Per Cent. of Total.	Crop Acres for Each Productive A. Unit.	Crop Index.	Acres of Potatoes.	Acres of Truck Per Farm.	Total Crop Acres.	Fertilizer Cost per Crop Acre.
Owner Farms (192)						
5 or less	17.6	97.8	9.9	4.9	66.7	$5.7
5.1–15	11.0	99.4	11.4	5.1	80.6	4.8
15.1–25	8.5	100.3	10.5	2.6	67.2	5.6
25.1–40	6.4	102.2	9.8	1.4	61.9	4.8
40.1–55	5.6	98.3	10.5	0.9	84.0	4.2
55.1 and over	4.3	90.3	3.7	1.7	50.9	3.2
Average	7.2	97.8	9.2	2.5	68.8	4.7
Cream Ridge Dairy Farms	4.4	97.8	3.1	1.0	89.2	1.7
Tenant Farms (68)						
15 or less	18.2	92.2	12.9	5.5	89.3	4.4
15.1–25	9.9	87.3	15.0	5.0	101.7	4.2
25.1–40	12.8	102.2	10.6	1.2	80.6	5.1
40.1–55	7.9	102.3	11.6	1.2	99.9	4.5
55.1 and over	6.4	89.6	4.1	1.3	88.9	2.0
Average	9.3	96.6	10.2	2.2	91.0	4.1

The crop yields appear about the same, regardless of the amount of livestock on the farm. This is in accordance with the results obtained concerning livestock on the potato farms of this county.

With the exception of the owner farms, which have 4.3 crop acres for each productive animal unit, the amount of fertilizer purchased is approximately the same per farm, regardless of the amount of stock. None of these farms are heavily stocked. During the summer cows are turned on pasture. The manure increase, therefore, would not be so large. Probably the difference in the amount of manure pro-

duced is not sufficient to make a noticeable difference in crop yields. The manure on many of these farms is not carefully husbanded. This would tend to nullify the value of stock for maintaining soil fertility. It is not the fault of the stock, but rather the methods of caring for the manure. Many of these farms are successful in their use of cover crops with potatoes and truck. Their rotations are not so long as to cause thin soil. In this manner they are able with the aid of commercial fertilizers to maintain their yields without depending upon stock. However, this does not decrease the value of stock for maintaining fertility on these farms. Under the system in vogue, stock had no apparent influence on crop yields and fertility. Again, farms not adapted to producing forage crops should not carry much stock.

The fertilizer cost per crop acre is comparatively low on dairy farms in this region. Less potatoes and truck also are raised on these farms, but the difference is not sufficient to allow such a large decrease in fertilizer expense and at the same time maintain the crop yields. Therefore, considerable stock on the dairy farms made farm manure which replaced much purchased fertilizer. However, until considerable stock is kept, the extra amount of manure which actually reaches the field does not greatly influence the amount of fertilizer purchased.

Truck Farms—Coastal Plain Soils.

The trucking industry of South Jersey is located upon the lighter and more sandy of the Coastal Plain soils. The topography and origin is similar to that of the potato area.

Crops.—The most common truck crops are sweet corn, asparagus, early potatoes, early tomatoes, carrots, lettuce, beans, rhubarb, cucumbers, melons, peppers, sweet potatoes, beets, onions, spinach, peas, egg plants, turnips, cabbage and others.

There is no regular rotation and the order of crops depends much upon the convenience of their arrangement.

Fertilizers and Manure.—Of a total of 300 truck farms studied, all used commercial fertilizers, 173 stable manure, 143 green manures, and 101 lime. The cost per crop acre for commercial fertilizers ranged from less than $1.20 to over $17.60; stable manure from less than $1.00 to over $12.90; for green manure seeds, from less than $.30 to over $1.80 per crop acre, while lime ranged from less than $.30 to over $2.10 per crop acre. The most successful truckers used a combination of all four fertilizers, manures, green manure crops and lime. Inasmuch as many truck crops do not allow for the growth of green manure, it appears as most essential that some manure must

be purchased. The truckers who used the heaviest applications of fertilizers, manure and green manure and lime, were the most successful. The most highly successful were those who made the green manure crops replace stable manure as far as possible.

The following data show the comparative results of heavy applications of stable manure, compared to commercial fertilizers and green manure crops.

TABLE VI.—*Relation of manure to crop yields and profits on 300 truck farms in New Jersey in 1914–15.*

Value of Manure per Acre.	No. of Farms.	Manure Cost per Crop Acre.	Lime Cost Crop Acre.	Fertilizer Cost per Crop Acre.	Crop Acres per Farm.	Receipts per Crop Acre.	Labor Income.
———	127	$——	$0.40	$6.00	38.09	$ 46.2	$299
0 –$ 2	55	1.00	.20	5.50	40.04	56.9	404
2.1–$ 4	39	2.80	.20	6.80	33.02	64.9	381
4.1–$ 6	30	4.90	.30	6.50	30.52	81.0	489
6.1–$10	31	7.40	.20	8.80	29.81	103.2	729
10.1–plus	18	12.90	.30	7.80	24.84	117.4	628
	300	2.20	.30	6.40	35.39	61.7	412

Relation of fertilizers to crop yields and labor income on 300 New Jersey truck farms.

Fertilizer Cost per Crop Acre.	No. of Farms.	Fert. Cost per Crop Acre.	Manure Cost per Crop Acre.	Lime Cost per Crop Acre.	Green Manure Cost per Acre.	Crop Acres.	Crop Receipts per Acre.	Labor Income.
$2 or less	25	$ 1.2	$1.5	$0.1	$0.3	33.58	$ 39.2	$373
2.1–$ 4	60	3.0	1.1	0.1	0.2	37.17	45.6	415
4.1–$ 6	82	5.0	2.0	0.4	0.2	38.70	54.0	342
6.1–$ 9	68	7.6	3.9	0.5	0.4	33.82	71.0	408
9.1–$15	49	11.0	2.0	0.2	0.5	34.97	85.5	555
15.1–plus	16	17.6	4.9	0.4	0.5	22.39	108.1	407
	300	6.4	2.2	0.3	0.3	35.39	61.7	412

Relation of green manure crops to crop yields and labor income on 300 New Jersey truck farms.

Value of Green Manure Seed per Acre.	No. of Farms.	Manure Cost per Crop Acre.	Fert. Cost per Crop Acre.	Lime Cost per Crop Acre.	Gr. Man. Cost per Crop Acre.	Crop Acre per Farm.	Crop Receipts per Acre.	Labor Income.
———	157	$1.4	$5.1	$0.3	$—	34.96	$49.4	$276.1
0 –$0.5	79	3.5	7.3	.2	.3	36.19	69.2	384.2
0.6–$1.0	37	1.7	8.2	.3	.7	37.88	81.4	927.6
1.1–$2.0	19	3.5	9.4	.6	1.4	32.68	85.9	476.8
2.1–plus	8	3.1	4.6	.4	1.8	30.73	73.8	827.0
	300	2.2	6.4	0.3	0.3	35.39	61.7	412.0

It is very evident that in all cases the heavier applications of manure, fertilizers or green manure crops gave the greatest yields. The trucker who applied six times as much manure as the average or three times as much fertilizer as the average, or grew two and one half times as much green manure crops, made the greatest profits. With the present desire to increase food production, these data have a vital bearing. Instead of clearing cut-over land or irrigating arid areas or draining swamps, fertilize the present tillable areas more. This would provide for an immediate increased production, make a more economical production, and would not injure farm lands throughout the country because large areas of cheap land would be brought under tillage which would compete with those now developed when Europe needs less of our food stuffs.

Of the materials necessary for increased production, stable manure is limited, but fertilizers and green manures would be plentiful.

In conclusion, it might be said that it is quite possible to maintain fertility and produce crops profitably on the general and potato farms through the use of commercial fertilizer and green manure. *Livestock does not appear to be essential in a region where green manure and especially leguminous green manure crops can be successfully grown.* From this, we might argue that one or two things are dominant, either livestock are merely a means of furnishing organic matter, or they merely are the means of returning plant food to the farm through the feeding of farm crops. The function of livestock in maintaining fertility probably will differ with the soil type or the locality. For example, in the Sussex area in all probability the most important function is to furnish plant food through the feeding of purchased concentrates, and the crops raised on the farm to the livestock; whereas, for some of the heavier soils, included in the Piedmont Plateau province, and the Coastal Plain province, livestock furnish plant food and organic matter in maintaining fertility of the soil. However, *it must be fully recognized that in each case, the maintenance of fertility is an essential in the management of the farm.* No plan of farm management which does not take into consideration the economical and proper maintenance of fertility, can be highly successful. Furthermore, this method will differ with the climatic condition, the soil type and the type of farming followed. Northern climates do not allow the successful use of cover crops, since the season is too severe and too short during which they can make their growth. Heavier soils are seldom so successful in the use of cover crops, whereas livestock farming seldom permits the use of cover crops to any appreciable extent, for most of the forage raised

on the farm is needed for feed. In such a case, the organic matter must be maintained through the provision of the heavy sods with the hay crop. On the lighter soils, heavy sods are very difficult to obtain, and the organic matter must be maintained either through the growing of green manure crops, or cover crops, or the purchase of stable manure. Truck farming does not always allow the use of green manure crops, because it interferes with the cropping sequence. The purchase of stable manure is too costly to allow the best profits, when it can be replaced by the green manure and cover crops which are the key to the most successful potato and truck as well as some general farms in New Jersey. Commercial fertilizers are needed to supplement both stable manure and green manure crops. Many farmers use too little fertilizers to obtain greatest profits in their farming operations. However, the American farmer is rapidly learning to use commercial fertilizers in the most profitable way. Education and experience are making rapid progress in our methods of maintaining fertility.

FARM ECONOMIC NOTES.

Mr. C. E. Allred, formerly Farm Management Specialist for Tennessee, has been appointed head of the newly created Department of Agricultural Economics at the University of Tennessee. In this department will be grouped all of the work done by the university in farm economics, farm management, and rural sociology. Considerable research work in these subjects is being planned.

"Opportunities in After-the-War Agriculture for Young Men Without Capital" was the subject of an address given by Prof. W. J. Spillman at the association meeting in Baltimore, Maryland, January, 1919. The information which was used as a basis for this paper has been published under the title "The Agricultural Ladder." Readers of the JOURNAL will find this in Federal Board of Vocational Education, Vocational Summary 1, 1919, No. 9, pp. 19–21. The above manuscript has also been printed by the American Association for Agricultural Legislation in Bulletin No. 2, entitled "Papers on Tenancy."

Farm Management Demonstrator McNall, of Kansas, has resigned in order to take graduate work at the University of Wisconsin. Mr. E. L. Rhoades, a graduate of the University of Missouri, will succeed Mr. McNall as Farm Management Demonstrator in Kansas. Mr. Rhoades was formerly an instructor in farm management at the University of Nebraska, and more recently was employed as a county agent at David City, Nebraska.

Assistant Farm Management Demonstrator George R. Boomer, of Nebraska, has resigned to become Extension Specialist in Marketing in that State.

The initial farm survey and business analysis made by the Office of Farm Management, U. S. Department of Agriculture, under the direction of Mr. E. H. Thompson, was conducted with the coöperation of the New Hampshire Experiment Station in Hillsboro County, New Hampshire, in 1909. In order to study some of the changes which have taken place in this area within the past ten years, a farm business analysis was made in the same county during the past summer, by the Office of Farm Management, U. S. D. A.

Mr. C. F. Sarle has given up his position as Scientific Assistant with the Office of Farm Management, U. S. Department of Agri-

culture, and has been appointed an instructor in agriculture in Simmons College, Indianola, Iowa.

The effect of the introduction of the tractor on farm organization is being investigated under a coöperative project between the Office of Farm Management, U. S. Department of Agriculture, and the Department of Rural Economics, Ohio State University. Continuous records will be taken for several years on one hundred typical Ohio farms. The work for the present season has been completed.

Mr. J. B. Andrews, who for six years has been connected with the cost accounting investigation work in Illinois, and more recently in charge of that work, will assume the rôle of Departmental Advisor in Farm Management, and will have charge of the farm management extension work in Illinois.

Mr. Edwin Mayland has resigned as Farm Management Demonstrator in North Dakota to accept a position as consulting agriculturist with a land settlement company.

The purposes and plans of the National Board of Farm Organizations were presented at the last annual meeting of the American Farm Management Association by Mr. Chas. A. Lyman, secretary of the board. Inasmuch as the objects and plans of the National Board of Farm Organizaitons have been set forth quite fully in the agricultural press, the address which was given by Mr. Lyman will not be printed in the JOURNAL.

A cost of production survey has recently been completed in four typical beet sugar districts in Utah and Idaho. This work was done by the Office of Farm Management in coöperation with the Office of Sugar Plant Investigations, U. S. Department of Agriculture. Similar records were taken by these two offices in three of the same areas during the years 1915 and 1916.

Mr. W. L. Harter has been transferred from the position of Assistant Farm Management Demonstrator in Iowa to the teaching staff. He will instruct the second year agricultural students at the Iowa State College. Mr. Russell C. Engberg, who has recently been released from military service, succeeds Mr. Harter in farm management demonstration work.

The Constitution of the American Farm Economic Association as amended at the last annual meeting (old text removed in parentheses and new text in italics) is reproduced on the inside back cover of this issue of the JOURNAL.